



Defense Business Board

BUSINESS EXCELLENCE IN DEFENSE OF THE NATION



EXECUTIVE ANALYTICS IN DOD & A REVIEW OF PRIVATE SECTOR BEST PRACTICES

DBB FY 22-02

AN INDEPENDENT REPORT EXAMINING HOW C-SUITE AND BUSINESS UNIT HEAD-LEVEL PRIVATE INDUSTRY LEADERS LEVERAGE ENTERPRISE-LEVEL DATA AND ANALYTICS TO INFORM DECISION-MAKING AND MAXIMIZE THE EFFICACY AND EFFECTIVENESS OF THEIR BUSINESS OPERATIONS.

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TASK:

On November 5, 2021, the Deputy Secretary of Defense requested the Defense Business Board (DBB), Business Transformation Advisory Subcommittee (“the Subcommittee”) submit an independent report examining how C-suite and business unit-head-level private industry leaders leverage enterprise-level data and analytics to inform decision-making and maximize the efficacy and effectiveness of their business operations. The Terms of Reference (ToR) provided by the Deputy Secretary of Defense directed the following tasks:

- Identify world class, private industry best practices to integrate metrics, benchmarks, and targets used to manage business operations to concretely identify areas for performance improvement, quantify risks and trade-offs, and validate the impact of strategic choices;
- Identify best practices and existing gaps in how private industry sets, reviews, and oversees its quantitative analytics priorities;
- Develop specific recommendations for managing enterprise business operations including presentation, periodicity, organizational level reviews, use cases, and approaches to apply these best practices to Deputy Secretary decisions and responsibilities; and
- Any related matters the Board determines relevant to this task.

OBJECTIVES, APPROACH AND METHODOLOGY:

The objectives of this private sector study were to:

- Identify private sector best practices in the collection of enterprise data, the design of new metrics, and the governance of & accountability for metric performance.
- Examine how the private sector leverages data analytics to drive business improvement.
- Examine how DoD is currently using data analytics
- Apply lessons from the private sector into recommendations for DoD.

The six-member subcommittee with the support of the DBB staff performed a six-month study addressing the following four primary components over 36 interviews of forty-eight individuals:

- Formal interviews with CEOs, COOs, CIOs, CFOs, and CDOs from top US companies recognized for analytics capability.
- Formal interviews with academic professionals who specialize in data analytics, the CDO role, and data governance models.
- Formal interviews with past and present DoD senior leaders
- A literature review including academic journals, published articles, previous DoD studies, and business case studies

EXECUTIVE SUMMARY

For over a decade, leading private sector organizations have demonstrated the value that quality data and advanced analytics bring to the effort of improving business performance and mitigating risks. It is widely known that private and public organizations collect, categorize, and analyze data to monitor operational expenses, optimize operational efficiencies, maximize potential revenues, profits, and market share. Large, firmly established private organizations that fail to adopt a mature data analytics capability face the risk of missed opportunities for enhanced growth and performance and are at risk of being surpassed by peer competitors. A single, trusted source of data is foundational to enterprise success.

Success factors for private sector companies who effectively leverage data analytics include:

- A strong, data focused culture throughout the organization that starts with leadership and is compelling to the employees;
- An alignment of key metrics with high level strategy and objectives;
- Strong employee accountability for key metrics via linkage with performance evaluation and rewards systems;
- Strong data governance and business processes which rely on the analytics for decision making;
- Cultural transformations to ensure durability of enterprise-wide analytics implementation;
- Evolving the organization's data maturity to an advanced stage that enables the implementation of business automation tools such as AI/ML¹

While private sector organizations typically lead the public sector in this area, many nations, especially China, have a clear, long-term strategic focus on big data analytics and AI/ML investments. Without a strong data analytics capability across its organization, the Department of Defense (DoD) faces significant peer competition risks. DoD's challenges in overcoming this include, its unprecedented size and scope, its siloed data, its risk averse culture², the significant number of information systems, and Title 10 complexities. These challenges make collecting and analyzing data at the enterprise-wide level difficult to implement.

During the past two decades, the Defense Business Board (DBB) has conducted studies on the use of balanced scorecards, executive dashboards, management tools, culture, and most recently the opportunity to leverage the data collected by DoD's annual audit process. While DoD has made significant progress in establishing the framework for its data management architecture, the DoD requested the DBB to focus its private sector expertise on how DoD can leverage its growing enterprise data architecture into an effective executive analytics engine. It is important to note that the tasking intentionally did not include the identification of specific measures to drive effective enterprise business operation.

Senior leadership in DoD not only needs the ability to view data from each of its armed services and thirty-three components rolled up at the enterprise level, but also needs all metrics tied into the National Defense Strategy (NDS) goals. Beyond leadership, employees at all levels need to have the ability to leverage enterprise data for informed decision-making.

With the development of its internally designed advanced analytics tool, ADVANA, DoD has steadily grown its reach and access across the enterprise to collect data on readiness and business operations. Although the reach into all 2,500³ Authoritative Data Systems (ADS) inside DoD has been limited due the team's resources and internal sharing concerns, DoD Directive 5105.79⁴ and DoD's Data Strategy policy clearly establishes the mandate that all DoD entities will share data with the ADVANA team. DoD's progress in enterprise data analytics is encouraging, however, as this study discusses, the DoD's road ahead

¹ Machine learning (ML) is a form of artificial intelligence (AI) where computers have the ability to learn from the patterns of previous data.

² <https://www.airforcemag.com/esper-culture-change-in-dod-needed-to-improve-acquisition-process/> "much more work remains to make the five-sided building change its overall risk-averse culture" Secretary Mark Esper, Jan 24, 2020.

³ Interview with ADVANA team 5/2022

⁴ DoD Directive 5105.79 <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/510579p.PDF?ver=SUsWJ8z8uc-gaEElle0OQw%3D%3D>

requires significant changes to DoD processes, talent, and its culture to successfully navigate its digital transformation journey.

DoD's recent policy changes involving data strategy, digital modernization, AI/ML, and the Chief Digital & Artificial Intelligence Officer (CDAO) reporting structure all demonstrate strong alignment with the private sector key findings in the study. While DoD has made real progress in setting up the organization with the tools, policies, and structure to build an executive analytics capability, compared the private sector, DoD has a long way to go on three fronts; (a) data culture transformation, (b) accountability for goals/metrics, and; (c) the timely completion of enterprise-wide data sourcing. These opportunities are explored in more detail in the recommendations section.

Key Findings and Observations Summary

1. An organization's strategic goals drive the selection of enterprise-wide objectives and C-suite metrics.
2. Organizations must understand their current capabilities, resources, and culture to determine the best path forward for an enterprise-wide implementation plan.
3. The organizational design and deployment of data analytics capability should use a federated model with the authority to enforce data governance and analytics standards across the enterprise.
4. Organizational culture must change to link key metrics to individual performance and reward systems and adapt as new analytical tools, capabilities, and skill demands are introduced.
5. Data sourcing, management, policy and organization is the fuel for any analytics engine
6. C-Suite metrics design should be based on the strategic plan, be reasonable in number, and be based on a top-down and bottom-up approach.
7. Organizations with a trustworthy, single source of enterprise-wide data in place find that capability improvements, particularly using artificial intelligence, occur rapidly.

Key Recommendations Summary

Without impact to existing data analytics initiatives:

1. The CDAO and CDO council must direct components to perform an assessment of the maturity of the data analytics strategic alignment, capabilities, resources, culture, and the organizational structure utilizing standard maturity models. Assessments enable the creation of a time and resourced-phased plan informed by the integrated results. Robust cultural change management is a critical-to-success element of the plan.
2. The CDAO through the Data Council must ensure measurable component/agency progress of DoD's Data Strategy Implementation Plans is collected and reported up to the DSD level for review each month.
3. DoD must review existing ADVANA data sharing policies to consider revising data sharing requirements from the Services, COCOMs, DAFAs and Agencies to include: (a) clarifying requirements for transactional data access; (b) establishing compliance dates; and (c) reporting compliance up to the CDAO and DSD level.
4. DoD must increase the speed of its progress with onboarding authoritative data systems (ADS) into the enterprise analytics tool (i.e., ADVANA). The CDAO or CIO must allocate appropriate resources to the ADVANA team to increase their current onboarding of the remaining ADS (i.e., 2,200) within the next 2-3 years. In addition, ADVANA must prioritize ADS onboarding and focus on the most critical systems and metrics relative to measuring NDS goals and priorities.
5. DoD must disseminate analytics Subject Matter Expert (SMEs) into its components/agencies faster. The CDAO's analytics Center of Excellence (CoE) has 20 SMEs. However, given

the size and scope of DoD, it should have 100 to handle all of DoD's 33 components. An increase must occur within the next 12-24 months to populate the critically important (embedded) analytics SMEs needed in each of the components. This will improve DoD's progress towards data strategy and analytics implementation to remain competitive with peer competitors.

6. DoD needs to create internally funded certification programs and CoE apprenticeships to upskill and reskill DoD civilian employees to improve data literacy and create an organic source of certified data scientists and analysts. Existing employee talent must be harnessed to make progress in DoD's digital transformation.
7. DoD should direct the DBB to perform a supplemental study of how Defense Civilian Human Resources Management System (DCHRMS) and other DoD performance management systems can be used or modified to adopt private sector best practices into its performance management systems.
8. Senior DoD leaders and their organizations should be measured on their use of existing authorities and administrative processes to manage poor performing employees. Interviews with DoD DHRA staff indicated that these authorities are not used frequently due to perceptions of difficulty. Existing authorities serve to correct and foster improved employee performance. Cultural transformation requires the ability to shape behavior and off-board employees unwilling to help in the transformation. In cases where existing authorities are insufficient to process poor performers, seek additional authorities.
9. The DSD should direct the Defense Business Council (DBC), to include an external perspective on emerging competitive, economic and logistical trends in its quarterly assessments to the Deputy Management Action Group (DMAG).⁵ The external perspective will augment the input from DoD components on the changing defense environment versus the metrics used to measure progress on NDS goals and priorities. The purpose of this assessment is to make recommendations on how ADVANA's current Executive Analytics display should adapt to changing conditions and inform DoD senior leaders more acutely on emerging issues. These recommendations should be presented as part of the DBC's quarterly update to the DMAG.
10. As the Data Strategy Implementation Plan matures, the department would benefit from an investigation on how the private sector is implementing AI/ML to transform business operations, and leveraging best practices in governance.

Respectfully submitted,



Linnie Haynesworth
Subcommittee Chair

⁵ <https://media.defense.gov/2021/Mar/11/2002598613/-1/-1/0/GOVERNANCE-STRUCTURE-FOR-DEPUTY-SECRETARY-MANAGED-PROCESSES-FINAL.PDF>

Preface

This study, DBB FY22-03, Exec Analytics in DoD & a Review of Private Sector Best Practices, is a product of the DBB. Recommendations provided herein by the DBB are offered as advice to the DoD and do not represent DoD policy.

The DBB was established by the Secretary of Defense in 2002 to provide the Secretary and Deputy Secretary of Defense with independent advice and recommendations on how “best business practices” from the private sector’s perspective might be applied to the overall management of DoD. The DBB’s members, appointed by the Secretary of Defense, are senior corporate leaders with demonstrated executive-level management and governance expertise. They possess a proven record of sound judgment in leading or governing large, complex organizations and are experienced in creating reliable and actionable solutions to complex management issues guided by proven best business practices. All DBB members volunteer their time to this mission.

Authorized by the Federal Advisory Committee Act of 1972 (5 U.S.C., Appendix, as amended), and governed by the Government in the Sunshine Act of 1976 (5 U.S.C. § 552b, as amended), 41 CFR 102-3.140, and other appropriate federal and DoD regulations, the DBB is a federal advisory committee whose members volunteer their time to examine issues and develop recommendations and effective solutions, aimed at improving DoD management and business processes.

The management of this study was governed by the Federal Advisory Committee Act of 1972 (5 United States Code (USC), Appendix, as amended), the Government in the Sunshine Act of 1976 (5 USC § 552b, as amended), 41 CFR 102-3.140, and other appropriate federal and DoD regulations.

Assumptions

For this study, we developed some key assumptions, to include:

- Organizations benefit from the ability to measure what matters.⁶ Regardless of the size and scope of the organization, analyzing performance data, even at the most rudimentary level, can identify improvement opportunities. Given its unmatched size, scope, and complexity, DoD would benefit from increasing its analytics capability.
- Senior DoD leaders want an enterprise-wide executive analytics capability, but delivering on that goal requires access to timely, accurate and useful data, and although sourcing of enterprise-wide authoritative data systems is underway, DoD hasn’t fully accomplished that yet.
- An organization’s data driven transformation is a cultural commitment that will require durable implementation plans that overcome the challenges associated with the high turnover rate of senior leaders.
- The application of private sector best practices to a complex and unique organization such as DoD can prove difficult. Executive responsibilities, performance measurement and rewards

⁶ Doerr John, *Measure What Matters*, Portfolio Publishing, Apr 2018

systems, and company cultures in the private sector are very different from DoD. Among the notable differences between the private sector and an executive branch agency, such as DoD, are:

- A. The recruitment, rewards, and retention practices in the private sector versus civil service employment in the Federal government. The federal government's emphasis on length of service rather than skills, knowledge and performance, and the high degree of difficulty in off-ramping DoD (federal) civilian employees for not meeting expected performance goals.⁷
- B. The strategy-focused culture and pressure to innovate in the private sector versus the risk averse⁸ culture in DoD that has been referred to as a threat to national security by experts in Congressional testimony.⁹
- C. The private sector performance evaluation systems that link employee incentives to KPIs that drive strategic goals versus the DoD's (multiple) internally designed performance evaluation systems that do not have the same level of consequences for poor employee performance.
- D. The serious (and often public) mandate on private sector senior executives to either deliver on key metrics or leave the company versus a perceived lower degree of consequences for senior DoD leaders to deliver on (KPI performance) expectations and strategic goals.

While we found that the private sector clearly demonstrated that the implementation of advanced analytics across a complex enterprise can yield significant operational benefits, the challenges for DoD will be getting in a position where these differences can be reduced, and solutions are implemented to produce similar results.

Key Findings

During the study, we found that private sector best practices in implementing executive analytics involved two phases: (1) **assessment/planning**; and (2) **implementation**.

1. The Assessment/Planning phase involves three areas that require attention:
 - o Strategic
 - o Capabilities, Resources & Culture
 - o Organizational Structure

An organization's understanding of where it currently sits in capability will dictate the lift needed to affect impactful change. These assessment categories can be performed simultaneously. The subsequent planning required after each area of assessment involves the identification, prioritization and resource phasing of implementation. The planning process is informed by the integrated assessment results.

2. The Implementation Phase involves four areas:
 - o Cultural change
 - o Data Management

⁷ <https://www.powermag.com/25-differences-between-private-sector-and-government-managers/>

⁸ <https://www.airforcemag.com/esper-culture-change-in-dod-needed-to-improve-acquisition-process/> "much more work remains to make the five-sided building change its overall risk-averse culture" Secretary Mark Esper, Jan 24, 2020.

⁹ Dr Adam Grant May 4th 2021 Dr. Adam Grant testified before the Senate Committee on Armed Services during a hearing on management challenges and opportunities at the Department of Defense "I also worry that DOD's culture is a threat to national security" <https://fedmanager.com/news/department-of-defenses-management-challenges-and-opportunities>

- Metrics design
- Leveling up

Cultural change, metrics design and data management efforts can all happen simultaneously. The implementation of advanced processes & tools (leveling up) happens once an organization has reached that nominal degree of data maturity.

Overall, covering both the assessment and implementation phase, we captured seven key findings, each of which we will cover below.

Key Industry Finding #1

Strategic goals drive the selection of enterprise-wide objectives and C-suite metrics.

Multiple C-suite executives with top US companies indicated that their Board of Directors (BoD)s and Executive Leadership Team (ELT)s’ annual strategy review covers long-term (3-5 years) and near term (1 yr.) strategic planning. In these annual strategic sessions, they identify market conditions, opportunities and potential disruptors. With input from the senior leadership team, the BoD re-affirms or adjusts the corporate strategic goals. The annual cadence of reexamined goals may result in a revised set of C-Suite key metrics from year to year depending on market conditions, competitive forces and growth opportunities.

The average number of metrics reviewed by a typical C-suite ranged from 8-12 with some as high as 30. Several reporting business unit (RBU) leaders stated their company’s strategic goals are viewed as ‘north stars.’ The executive metrics are aligned to the strategic goals which cascades down to the RBUs where BU level metrics are designed to measure progress towards the aligned strategic goal. The RBU metrics are then pushed upwards, combined with identical metrics from other RBU’s, and are reviewed monthly by the ELT.

The C-suite executives from companies that underwent an analytics transformation stressed the importance of having an overall analytics strategy. An analytics strategy connects the organization’s strategic goals with the aim of the analytics and to the required inputs (data). Its purpose is to ensure that all analytics activities throughout the enterprise are clearly mapped to the support of strategic goals.



Current State in DoD

DoD openly publishes and communicates its strategic goals in the National Defense Strategy (NDS). The NDS clearly states its 2 main goals and 3 lines of effort and senior DoD Leaders and their respective entities use them as north stars. DoD reviews, resets & republishes NDS goals every 4 years. This cadence is analogous to private sector long term strategic goal planning. DoD executive dashboards roll up to 6 metrics at the DSD level (tied to NDS goals and priorities) and expand as needed, which compares with private sector best practices. The NDS goals do cascade down the DoD organization into the top level of each component, but as enterprise data is sourced from systems in various components and brought into ADVANA, there is an expectation for components to set goals or thresholds for the metrics they provide. A large portion of metrics in ADVANA still require goals, which are crucial when measuring success. Although there is visibility and monthly reporting on metrics without goals, DoD does still have a challenge as they work with system owners.

Organizations must ensure that all RBU's treat strategic goals as their north star. The number of strategic goals is intentionally kept small, so everyone knows and understands how their RBU, department, division, and functional office contributes to their organization's strategic goals. Additionally, organizations must be able to link strategic goals to employee behavior and actions. Effective organizations link their strategic goals to the RBU metrics which are then tied to employee performance and reward systems.

Effective data driven organizations also have an informed BoD & ELT that carefully contemplate major strategic decisions and trade-offs. Organizations must also act decisively and clearly communicate its change-management plan in a comprehensive and deliberate manner across the organization to garner buy-in at all levels of the company. Conversely, ELTs that allow BU's to veto or obstruct forward action on a strategic decision will lose advantage, time and opportunities in the marketplace.¹⁰

Key Industry Finding #2

Organizations must understand their current **Capabilities, Resources and Culture** to determine the best path forward for an enterprise-wide implementation plan.

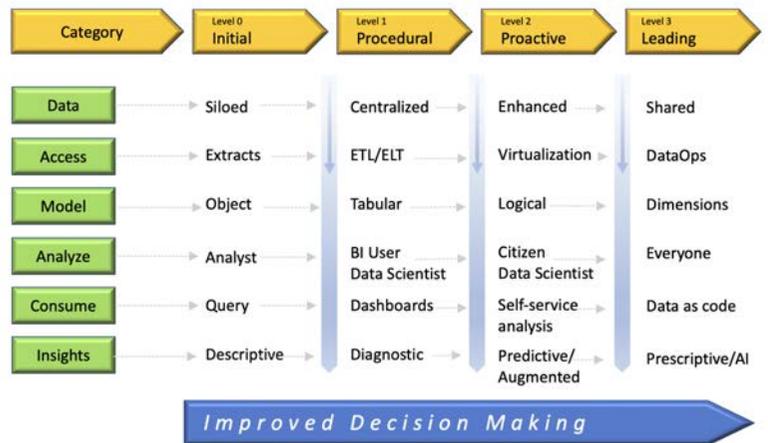
Capabilities:

Over time, private sector organizations developed roadmaps for improving data as well as analytics capabilities. The more commonly known roadmaps are Data Maturity Models (DMMs) and Data Analytics Maturity Models (DAMMs). Academic leaders interviewed for this study confirmed that Data Analytics Maturity Models enabled organizations to better evaluate their level of data¹¹ and analytics capability compared with those who went through a similar data transformation journey without models. Maturity models provide linear and incremental building steps designed to help organizations visualize the path to reach full capability. Additional factors to consider as part of the implementation plan include ownership of the maturity model (typically the CIO or CDO), accountability for progress and establishing future-state goals (CDO).

¹⁰ Interview dated 14 Feb 2022

¹¹ Interview dated 6 Jan 2022

The increasing levels of proficiency and sophistication are a framework for data and analytic maturity models and often used by organizations as benchmarking tools. Maturity models enable organizations to evaluate and plan to close any gaps found after self-assessment.



The model¹² recommended by an academic expert suggests six capabilities required to build a data and analytics capability across an enterprise.

Descriptions of the Data and Analytics Maturity Model					
<p>Data</p> <p>The assessment starts with data, the fundamental component and fuel for executive analytics engines. Data must be trustworthy, organized, subject to governance, and fully accessible.</p>	<p>Access</p> <p>Data is not an enterprise asset if it is siloed off inside a specific business unit. As organizations mature, they will increase their level of sophistication in data extraction from legacy or stand-alone IT systems throughout the organization.</p>	<p>Model</p> <p>As organizations extract data from across the enterprise into a single, trusted source, they will create a meta-data framework to help business users understand how to translate new data fields into information that supports self-service.</p>	<p>Analyze</p> <p>As an organization slowly embraces data analytics, the analyst user-base grows. It begins with certified data analysts and ends with the empowerment of any employee to solve business problems through analytics.</p>	<p>Consume</p> <p>As organizations advance in data maturity, the medium through which users consume data evolves in sophistication but also ease of access for users. Dashboards of analytics are force-fed data views whereas self-service analytics enables users to design ad hoc queries at will for changing business environments.</p>	<p>Insights</p> <p>Insights are the lightbulb moments users experience when reviewing the analytical products. An organization's insights will evolve from descriptive (using current and historical data to identify trends and relationships) to predictive and on to prescriptive, where AI/ML helps a business see what coming *and* decide how to respond.</p>

Senior executive teams who are eager to push their organizations rapidly into using AI/ML against large data sets have found success where the large data sets exist within a specific business unit. However, where the data resides in multiple IT systems and data definitions vary across the enterprise, the company often scores lower on the maturity model and requires more work before advanced tools like AI/ML can be effectively implemented.

¹² <https://www.atscale.com/blog/introducing-data-analytics-maturity-model/>

Interviewees found maturity models helpful in the following ways:

1. Organizations do not need to aim for the highest maturity level but do need to hit capabilities that reflect key organizational goals and values.
2. Introducing and disseminating analytical capabilities should be done incrementally to ensure adoption, understanding, and durability.
3. Uneven allocation of data-centric talent will mean that some areas of the organization will develop analytical capabilities before others, and this is acceptable provided incentives are employed to create cultural adoption compliance.
4. The models enable an enterprise-wide view of data capabilities and help leaders see the wide-ranging impact of analytics on business performance.



Current State in DoD

Overall, if/when compared to industry standards of organizations with the same size and complexity of systems, DoD's enterprise data analytics capability sits at a mid-level stage of maturity.

Dashboards are in use and the organization is in process of extracting data from across the enterprise into a single trusted source (ADVANA). There are pockets of excellence inside DoD that operate at a much higher level of analytics maturity (service branches & acquisitions/sustainment).

Data leaders in DoD are familiar with and have utilized data maturity models in the design and implementation of its advanced analytics platform ADVANA.

Ultimately, the use of maturity models is an important first step for an organization's data analytics journey. These models evaluate their current capabilities and assist in establishing implementation plans of capabilities that help them reach strategic business goals. However, it is important to note that these models are intended to inform the implementation plan, not *be* the implementation plan. Assessments will dictate the level of customization required.

Resources:

Money

One primary question organizations faced when implementing enterprise-wide analytics efforts was 'how much should we budget for an organization of our size?' The answer to the question depends on the status quo of the organization's talent, resources, and culture and the amount of capital expenses needed to transform the organization's components to deliver necessary capabilities.

C-Suite executives interviewed for this study suggested an organization's budget for data transformation should start small and scale up over a longer-term horizon. For context, a large organization's data analytics budget is typically 10% of the CIO's total budget.¹³ The exception to this are organizations where data **is** their business (i.e. digital content, search, social, etc.).¹⁴ In these cases, the data analytics budget can be 15%¹⁵ of the CIO's budget and will be dependent on two parts: (1) the cost of building and running the technical ecosystem for data science, which includes the infrastructure,

¹³ Interview follow-up 9 Mar 2022.

¹⁴ Interview Dated 26 Jan 2022. In an industry for which data is a core competency (e.g., tech generally), analytics spending typically grows faster than company revenue for foundational work (starting from scratch). Over time, growth in analytics spend should slow to be in line with revenue growth and eventually grow less than revenue because competencies have been built that scale through metrics, dashboards, models, etc.

¹⁵ Interview follow-up 13 Mar 2022

collection and access to data, and productivity tools for data scientists; and (2) the cost to acquire resources, which includes hiring talent (data scientists, data engineer, outsource partners, etc.) with the data science skill sets and domain knowledge of the items they are seeking to model.

Notably, organizations must bring on expertise during the initial phase of their data transformation to include: data scientists, data engineers, and cloud engineers. These roles form the nucleus of the team¹⁶ that develops the enterprise strategy and identifies the initial partners to work with. This small team of data experts build the business case and scale the funding plan over a 3–5-year horizon and, in parallel, show initial results in order to validate and refine the approach. It will be important this 3–5-year budget is secured in advance to allow the team to start the build out on both parts listed above. One manner suggested for setting an appropriate budget for enterprise data analytics is to start with the business outcomes in mind and then reverse engineer the analytical capabilities to achieve the outcomes. The tools, talent, and upskilling should all be factored into this calculation.¹⁷

An organization’s data budgeting goal should initially align on a set of use cases where the value of analytics to an organization is clearly demonstrated, and the necessary resources required to bring those use cases to life are identified. The four primary dependencies for the budget considerations identified were: (1) Analytic resources; (2) Analytic technology tool/needs; (3) Data engineering; and (4) Last mile integrations/deployment of use cases. Critically important in this calculation are the people, processes and tools required for managing data governance. C-Suite executives advised initial use-case budgets should be a relatively small investment for the organization based on a fraction of the company’s total revenue (or total budget for public institutions), with a large portion of this expenditure dedicated to resources and data infrastructure.

Once the analytics team is capable of demonstrating the value of data integration and analytics, an increase in investment to grow the organization’s budget will become justifiable. However, the growth needs to align to business/corporate priorities versus technological capabilities.

Tools

A majority of the C-Suite executives interviewed for this study stated that they have either already migrated their data centers to the cloud or were in the process of doing so. These executives stated it was more cost effective across the organization to utilize



Current State in DoD

DoD has internally developed an advanced analytics tool, ADVANA. The design and implementation of ADVANA has been kept intentionally lean from the outset and its organization reflects that lean design and low overhead. Using private sector ratios, and assuming that the ADVANA team, CoE, and tool development represents a large share of the overall DoD analytics budget, the ADVANA budget should be larger than its current size. This is based on a perceived low throughput of onboarding new systems and the constraints of having a data sourcing team that is smaller than required. Although money is not always the solution to moving faster and maintaining quality, at its current onboarding rate of 70 authoritative data systems (ADS) every 3 months, it will take the ADVANA team 7.9 years to finish the enterprise. A focused budget increase to increase throughput could help them onboard all 2200 (remaining) systems in 2-3 years.

¹⁶ Interview dated 15 Dec 2021

¹⁷ <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/public-sector/us-fed-data-analytics-and-budget-formulation.pdf>

software as a service (SaaS) cloud-based analytics tools, than otherwise. Depending on the chosen platform, cloud-based solutions are able to provide a wide-range of analytical tools with scalable costs as the organization grows. Integration, configuration and some custom development are often needed with a 3rd party data and analytics solution, depending on the data being integrated and the analytic and other business use cases for the data. While most off-the-shelf SaaS solutions do not perfectly plug and play with other systems, they are still more cost and time effective compared to a completely custom implementation.¹⁸

Conversely, because of data sensitivity or proprietary services, some organizations required in-house analytical platforms, which, they said, took years to design, build and implement. Some risks with in-house platforms included development costs, maintenance costs, and an aging technical infrastructure. Several large companies interviewed used the in-house design approach and were satisfied with the success of their internal analytical platforms and key components of their digital transformation. Other companies in the Defense and Aerospace industry chose a hybrid¹⁹ model that allowed them to use cloud storage for non-sensitive data and keep on-site control over sensitive data.

Talent

Aside from a cultural reinvention, (discussed later in the report), finding the right talent to implement and utilize new analytical tools is one of the biggest challenges for any organization. The data analytics maturity model provided demonstrates the different stages of capability and varied skill sets required to implement at each level.

However, not all of those skill sets are required at the starting point, so the acquisition of new talent can be manageable. As several of our interviewees pointed out, this type of talent is among the most highly sought after in the marketplace. Their solution to this talent competition dilemma was to implement incentive programs to encourage existing employees to upskill or reskill into data-centric roles needed by the company.

One company²⁰ described a solution that involved creating an enterprise-wide skill-based catalog of all employees that tracked their certifications, role experience, and desire/willingness to learn new software or coding languages. This interactive platform pushes suggestions to different employees about future requirements (languages, certifications, etc.) that will help them add more value to the company. This approach



Current State in DoD

DoD has a significant need for data scientists, data engineers, and migration specialists to finish the work begun by the ADVANA team and then populate the various components with analytics talent. The private sector aggressively pursues the same talent as DoD, but DoD can not compete with private sector pay, benefits, culture or time to hire. Other than the satisfaction of serving your country, there are few tangible reasons, DoD gives young data savvy talent to choose it over lucrative private sector offers. The alternative to recruiting (scarce) outside data talent is to provide incentives and opportunities for talented (existing) employees to upskill or reskill into a data science career. DoD's analytics budget could include funding to train and certify in-house talent in exchange for a 3-5 year payback tour.

¹⁸ A quintessential problem for large, complex organizations similar to DoD is the Make or Buy decision. The organization can MAKE its own system over an extended period of time and ensure the capabilities are customized to internal needs, or BUY and implement commercial off-the-shelf technologies (faster than proprietary) and which allow more frequent updating and integration with other platform systems.

¹⁹ Hybrid cloud model uses both on and off premises virtual private clouds (VPC)

²⁰ Interview dated 16 Feb 2022

was described as surprisingly effective at upskilling/reskilling their existing workforce. The presence and capability of existing analytics talent in an organization will dictate the need for Upskilling, Reskilling, and Recruiting.

Culture:

A data culture assessment is one of the first and most important self-evaluations an organization must make prior to introducing or advancing the use of an analytics platform. It provides a clear picture of how comfortable the majority of the organization is with using data and analytics to drive decisions. It also provides some early insight on how challenging it will be to introduce this type of change to the organization.²¹ Any cultural change in an organization can be challenging, especially when it requires many employees to embrace new platforms, software, technology, and change in general to do their job.²²

When conducting data culture assessments, large organizations may find vastly different degrees of maturity across the organization. This is due to the prevalence of existing analytics use, skill sets, and the expectations of leadership in different business units. In terms of ownership and execution, executive leadership drives the culture, and business units reinforce it. Every executive is responsible for reinforcing culture, but the CIO and / or CDO has ownership of data and HR typically conducts talent and organizational assessments.



Current State in DoD

DoD's components can assess their data culture using the four key areas used by the private sector to self-assess. DoD does have **data driven leadership** at the top levels of each service & agency, but the intensity fades below the top layers. DoD now has a designated **single source of truth** (ADVANA), but not all components use it as such. The **data literacy** of DoD employees is generally poor, reflected by the inability of most DoD employees to identify the KPIs used by their own department as well as how the data they own or manage relates to those KPIs. DoD's **data-driven decision making processes** would be better if all components made decisions from a single source of trusted data.

There are four key areas used by companies to assess their organization's data culture:

- **Data-driven Leadership:** Do the organization's leaders recognize the power of data and analytics to solve business problems and do they set the example by expecting direct reports to act similarly?
- **Data Maturity:** Is there a single source of truth for data that employees know and recognize? Is the data generally perceived as accurate & transparent? Can employees access this system easily?
- **Data Literacy:** Does everyone in the organization have a basic understanding of the company's data related to their job role? Do these employees feel comfortable using this data to solve business problems faced by their role? Do they know where to find the data and how to access standard reporting on a metric?
- **Data-driven decision-making process:** Do leaders up and down the company hierarchy use the same data source for decision making? Do they require the use of trusted data systems during periodic business reviews?

²¹ Interview 13 Jan 2022 "Culture metrics comes from an annual survey we do."

²² Leary, Lauren M., "Assessing Organizational Data Culture to Create an Ideal Data Ecosystem" (2015). Capstone Collection. 2799. <https://digitalcollections.sit.edu/capstones/2799>

Data culture assessments²³ are either performed internally or externally by 3rd parties. These assessments are effective tools for any organization when setting their data culture baseline and for implementing a data transformation plan.

Internally performed surveys are performed by the Chief People Officer (CPO) or Human Resources Office (HRO) who execute internal surveys that are designed by subject matter experts (SMEs) on the CIO/CDO teams. The HR team organizes response data into an overall assessment for the senior leadership team.

Externally performed surveys are executed by an outside firm that conducts employee surveys (with the company driving the areas of focus) and provides anonymized results to the senior leadership team.

Key Industry Finding #3

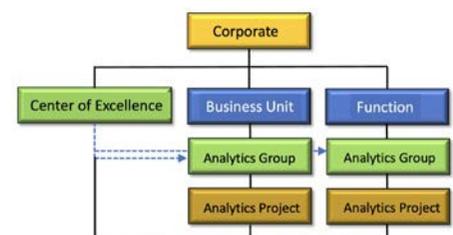
The **organizational design** and deployment of data analytics capability should use a federated model with the authority to enforce data governance and analytics standards across the enterprise.

Typically, an organization's data analytic structure is described as centralized, decentralized, or federated. The majority of C-Suite executives interviewed stated that they redesigned their data organization with a federated model including a CoE that established governance and provided analytics support to RBU leaders. This design is often described as a matrixed organization where data analysts are administratively owned by the CoE, but operationally embedded with different business unit leaders based on demand and need.

A **federated** structure organizes data analytics for the enterprise with a central hub responsible for governance functions and still allows business units to tailor analytics to their specific needs.
In a **centralized** structure, responsibility for execution of analytics & governance authority are concentrated in a HQ unit. Analytics requests are received and prioritized based on importance.
A **decentralized** structure distributes data analytics authorities & responsibilities to business units. This provides them with autonomy and no expectation for coordination.

The goal of a federated data analytics program is to maximize benefits for the organization. While business units can build effective analytics solutions quickly when utilizing a centralized structure, the data tools created are often not scalable. In contrast, a federated organization provides both agility and scale, flexibility and consistency.²⁴

The most commonly discussed CoE structure is depicted here. Organizations may have multiple business units and multiple functions (HR, Marketing, Sales, etc.) in their company, but for simplicity, only one of each is depicted. The CoE functions at the federal level, and floats above and outside the RBU's/Functions to support them both indirectly (with talent, templates, governance, etc.) or directly, serving as an emergency overflow capability to handle excess analytics required in business units.



²³ <https://digitalcollections.sit.edu/cgi/viewcontent.cgi?article=3845&context=capstones>

²⁴ <https://www.eckerson.com/articles/organizing-for-success-part-ii-how-to-organize-a-data-analytics-program>

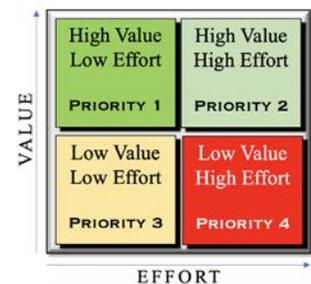
The C-Suite executives from large organizations interviewed for this study all stated the federated model was the ideal model for their companies. A federated model includes specific teams (i.e., data management team, the business intelligence (BI) team, and data science team) who are deemed competency centers to provide coaching and support to the business units and their employees.²⁵ The presence of individuals from centralized teams embedded at the business unit level increases support by providing an overflow capability to handle larger, more complex analytics to business units that lacked capacity. One executive from a large, hi-tech firm²⁶ said the analytics experts from the CoE who physically sat with the business units were viewed as enablers that helped them achieve business results and identify risk. The roles of these embedded analytics experts included: (a) support the RBU leadership and empower their decision-making with analytics; (b) train the business unit staff to use analytics; (c) follow governance models; (d) ensure that RBU analytics map to enterprise goals; and (e) encourage adoption of the analytics tools.



Current State in DoD

The CDAO in DoD does currently have a CoE for analytics, but it has a much smaller headcount than large private sector companies. It is currently staffed with 20 data scientists that are currently embedded with each COCOM HQ. The current scope of the CoE seems limited to training DoD employees on using the ADVANA platform and providing embedded expertise to component leaders. DoD's analytics CoE should have a two-fold mission of (1) embedding expertise and (2) lifting the data literacy of DoD's employee base. The size and current scope of this CoE appears to be an initial phase and based on private sector best practices, one would expect that soon, the size of this CoE will increase to 5x its current size within 12-24 months to sufficiently achieve DoD's data strategy and analytics implementation.

In addition to these roles, embedded analytics experts are also responsible for prioritizing analytical needs for an RBU. Working closely with the RBU senior leadership enables these experts to gather requirements and rank them in terms of two things: (1) value to the company and (2) effort required. The quad box figure here, which is similar to an Eisenhower decision box, is provided to visualize the prioritization of analytical needs discussed by executives.



Several executives also discussed the challenges that their CDOs often faced during implementation. One challenge in particular was working with RBUs that were unreasonably withholding access to specific authoritative data systems (ADS). The two common solutions discussed to deal with this challenge were (1) Set up regular monthly briefings with top leaders (CEO, COO or CIO) on the progress of onboarding new ADSs and use the venue to request help in motivating specific ADS owner(s), and (2) Grant the CIO or CDO review & approval authorities on IT budgets for all reporting business units. This creates an additional degree of influence in the willingness to share data.

Several organizations participating in this study faced varying obstacles during their data transformation journey. For organizations with an existing, but siloed, data analytics capability, a shift into a federated model required moving talent across their business units and recruiting additional talent from outside the organization. For organizations with little to

²⁵ ibid
²⁶ Interview dated 14 Feb 2022

no data analytics capability, executives found the best solution for their organizations was to recruit and staff a small central office, then incrementally build up their capabilities, (i.e. draft data use policies, publish governance policies, develop and train expertise, etc.).

Key Industry Finding #4

Organizational culture must change to link key metrics to individual performance and reward systems, and adapt as new analytical tools, capabilities, and skill demands are introduced.

Organizations must frequently pivot their product offering, market niche, core skill sets, organizational structure, and business processes to remain competitive in the marketplace. These pivots are significant, and typically difficult and lengthy to navigate. Pivoting is, however, absolutely necessary for survival, and without strategic pivots, organizations may not survive evolving market conditions. Business leaders know that major change in their competitive landscape is inevitable. They also know that the vast majority of employees, especially those near retirement, don't like change, especially when it involves new technology or skill sets.

Many executives referred to their organization's introduction of enterprise data analytics capability as a 'significant pivot' that required a cultural shift to ensure successful adoption. Many of these executives described their journey as part of a digital transformation that touched nearly every employee, every business process, and every decision. At the core of this transformation, the most critical component discussed was and is - the employee. The organization's employees are the most critical factor because they are the ones who must embrace and implement the new tools and business processes. Without employee buy-in to data analytics, and the adoption of new behavior, organizations do not transform. In addition, every organization said that it was critically important to link individual performance measurement and reward systems to the KPIs to ensure sustainable success.

The executives discussed, at length, several approaches they undertook to ensure a successful cultural shift. Some of the approaches discussed include the following:

1. **A data driven cultural change starts at the very top of an organization.**

Organizations have senior executives who set a clear expectation that data will support and create the environment where data driven decision making is standard practice.^{27, 28} Several

²⁷ <https://hbr.org/2020/02/10-steps-to-creating-a-data-driven-culture>

²⁸ <https://hbr.org/2019/07/building-the-ai-powered-organization>

senior leaders²⁹ said their own behavior (demonstrated) in meetings quickly traveled across the organization as legend and became a new cultural doctrine.

- At one internet retailer, a senior executive reviewed one thousand metrics during a monthly executive leadership meeting, randomly digging 3, 4, & 5 layers deep into the causality (data) behind a poorly performing metric.³⁰
- At a Fortune 50 tech firm, the CEO declared to his business unit leaders that their new enterprise analytics platform was now the ‘system of record’ and for future business reviews, admittance to the meeting required data from the system of record.³¹
- The CEO of a leading digital content provider reviewed dashboards and poorly performing metrics from every business unit and sent personal emails (directly) to junior and mid-level executives (owners) asking if their data/metrics are accurate.³²

**Current State in DoD**

Senior DoD leaders have recently begun to require the use of the designated, trusted, single data source during specific senior leader meetings. Real time data is reviewed during the meetings and attendees have full visibility to everyone’s metrics. Culturally, this has created a shift, but only at the very top of the organization. Similar leadership behavior and practices will have to be replicated down into reporting business units for the cultural needle to move. Past and present top DoD leadership does have the reputation among staff to dig deep into the causality behind red metrics, but this leadership principle must also be replicated down the organization to affect cultural change.

These are just a few out of dozens of anecdotes we heard from top US Companies about how their leader’s behavior set the example at the top. These anecdotes set forth a clear message - ‘if the CEO is looking at data, then everyone else should too.’ The messaging from the top not only centered on accountability, but senior leaders also emphasized the positive benefits of data analytics to each reporting business unit’s output.

Interviewees discussed the process of defining key metrics at an executive level, and working with leaders to ensure that metrics are created at each level that ladder up to the organization-wide metrics and goals. Additionally, senior executives suggested that continuous messaging, investment in training, and communicating how they are using performance information can institutionalize change in the company’s use of data analytic systems and convey credibility in a decentralized way across the firm.

2. Linkage between metrics and employee performance measurement and reward systems

One factor for an organization’s cultural data transformation centered around transparency of metrics linked to performance. A senior partner in a top US management consulting firm said, “the most effective way a large organization can make a lasting cultural change is to link key metrics to personal incentives.” While this comment side-steps many other factors that drive workplace behavior, there is truth to this point - *Employees pay attention when their pay and performance bonus is involved.*

Numerous senior executives described the linkage process from strategic company goals, down to business unit, then division, and finally department goals. One clear objective of

²⁹ There are several challenges associated with each of these: 1) idiosyncratic CEO leadership styles and behaviors; 2) perceived micromanagement and a culture of ‘gotcha’ versus accountability that makes all employees owners; and 3) a need to institutionalize change beyond individual leaders. Interviewees noted that systems can become institutionalizing forces starting from when new employees are on-boarded to annual performance reviews.

³⁰ Interview dated 7 Jan 2022

³¹ Interview dated 10 Feb 2022

³² Interview dated 26 Jan 2022

their cultural transformation was creating transparency in linking the employee's metrics³³ directly to strategic company goals. These senior leaders claimed their employees felt an increased level of contribution and ownership towards the accomplishment of enterprise-wide goals through work-results feedback loops which are at the center of performance systems.

Executives cautioned that individual metrics performance evaluations should include more team and enterprise level performance metrics than individual performance metrics. In the effort to change cultural behaviors and drive the right enterprise-wide actions, organizations should shift financial incentives more towards higher-level team metrics. This encourages employees to pull together in the same direction rather than focus solely on their own performance.

Many senior executives also described using a carrot and stick approach to affect the cultural shift required to adopt new technology and business processes. The 'carrots' implemented were in the form of incentives for reporting business unit leaders and their employees, and the "sticks" were in the form of limitations (an artificial ceiling) on previous incentive levels. For example, bonuses in a reporting business unit were limited to 50% of the possible maximum amount if the business unit's Diversity, Equality, & Inclusion (DEI) metrics fell below expectations tied to strategic goals.³⁴ On the other hand, reporting business units and employees that either embraced the new platforms or achieved small wins were widely celebrated. Senior executives also routinely recognized and rewarded employees across the enterprise for living the (new) values consistent with a data driven organization.

Several leaders also strongly suggested that non-monetary rewards were extremely effective as motivating levers. Suggestions included: (a) Public recognition by the top leadership in front of their peers, (b) Small and select group engagements with the CEO or other C-suite staff, and (c) Opportunities for employees to transfer to exciting new assignments or departments in the company.



Current State in DoD

DoD's DCHRMS system may be able to provide a functionality that aligns with the private sector best practice of keeping a skill-based inventory system for all employees. In the private sector, a interactive platform pushes suggestions to different employees about anticipated future certification requirements for their position (languages, certifications, etc.) that will help them increase their chances for promotion and greater pay. Tracking employee skills and certifications is a key lever private sector employers use to transform into a data driven culture. DCHRMS may provide a similar capability. A skill-based inventory system could contribute to DoD's cultural transformation by providing more insights into employee skills, knowledge, and willingness to learn new emerging technology.



Current State in DoD

One former DoD leader voiced frustration that some inside DoD occasionally use 'watermelon' charts, (green on the outside but red on the inside after exploring lower levels of data). The tendency to shelter 'red' metrics from enterprise visibility is occasionally seen in private sector firms. However, it is not seen in private sector firms with data driven cultures. If this tendency is indeed present inside DoD's culture, it can be addressed through adopting the private sector principle of data transparency across an enterprise-wide data architecture. Expanded adoption of DoD's Advanced Analytics Platform will begin to address this challenge but senior leaders must drive the cultural change to reinforce an **'Embrace the Red'** mindset.

³³ More specifically, they discussed the linkage of higher level, organization and company-wide metrics within an employee's performance plan. Best practices discussed the mix of an employee's performance plan to include higher-level, company-wide metrics and individual metrics, with the majority of the evaluation focused on company-wide metrics rather than individual.

³⁴ Interview dated 15 Dec 2021

The carrot and stick approach is symbolic of an adage frequently discussed in change management - *you're either on the bus or off*. Senior executives acknowledged that cultural change is uncomfortable and often required personal time and sacrifice to learn new skills and obtain new certifications. To offset their employees' sacrifice, companies offered incentives. For the small percent of the workforce who were not willing to adapt to the new culture, the executives pointed out that the change-averse employees faced an ultimatum - they were eventually encouraged to explore employment opportunities elsewhere.

3. Adopting new mindsets such as 'Embrace the Red' in pursuit of stretch goals and learning

Interviewees found that leaders throughout the organization needed to communicate to all employees a series of new mindsets: The first mindset is 'it's okay to fail' when implementing change or striving for new, innovative outcomes. Executives that stressed the importance of replicating this mindset throughout the organization suggested that it is a byproduct of requiring 'stretch goals' from all leaders.

The second mindset was 'embrace the red.' This mindset helps organizations encourage business unit leaders and managers to share business metrics and data traditionally sheltered from enterprise level visibility because the metrics typically fall below expectations (coded as red) for various reasons either known or unknown to the business. This mindset encouraged employees to acknowledge that they're part of a great company and that addressing 'red' metrics meant the company will get better as a whole. In turn, the business process improvements may directly or indirectly have a positive effect on employees' performance bonus/incentives.

One large manufacturer in the aerospace industry discussed celebrated circumstances that, prior to the cultural shift, would have been unusual. One example was celebrating the sunsetting of legacy IT systems. Another one was recognizing employees who made real progress in using data for decision making, even when the targeted outcomes were not achieved. Another realized promise of their cultural shift rewarded intelligent risk taking even when they fell short of audacious goals.

4. Change management (projects) in each Reporting Business Unit

Many senior executives recommended using change management principles³⁵ to ensure a successful implementation. These principals ensure proper resource allocation, communicate the urgent need for change, gather buy-in from all levels of the organization, manage the implementation of change, and engage in active and ongoing communication efforts from the top and throughout the organization. Interviewees said that change management principles were used at both the enterprise and business unit level to ensure success. Large and small-scale change management projects were chartered with a keen focus on communicating the benefit of the change aligned to organizational strategy, mission, and purpose.

³⁵ The four change management principles are (1) Understand Change, (2) Plan Change, (3) Implement Change and (4) Communicate Change

Utilizing these principles ensured continued leadership support and engagement during the lengthy process of culture change. Many executives suggested the best approach was for project teams to start small, and incrementally generate support using focused, high-impact analytical projects that resulted in financial incentives for each business unit employee.

Durability of Change Efforts

When implementing their new capability, companies made specific and intentional efforts to ensure that it had an element of durability that would withstand changing leadership or the resistance of the frozen middle. These efforts included clear role accountability and deliverables for middle and senior leaders, implementing linkages between strategic goals and RBU KPIs and then KPIs to individual employee incentives. In addition to these efforts, companies described requirements from their BoDs and shareholders to develop and update a 3-to-5-year strategic plan. The interviewees stressed the importance of this plan in terms of added durability. They explained that pulling back from long-term plans already approved by the BoD was a difficult process that required significant justification and senior leader buy-in.

Key Industry Finding #5

Data sourcing, management, policy and organization is the fuel for any analytics engine

Aside from managing the cultural shift required to improve data literacy, the second biggest lift in the implementation of enterprise analytics was building a trustworthy enterprise data foundation for use up, down and across the organization. A consensus of the executives interviewed stated the process of mapping data fields/definitions with business unit subject matter experts across the array of different IT systems was one of the most important enablers for effective, executive analytics. With the appropriate resources, this process typically took between 12-18 months to complete.

Several components of building a trustworthy foundation were discussed, to include:

Data Sourcing & Mapping

Accessing data and cataloging IT systems across the enterprise

One of the most time-consuming efforts described by the CDOs and data analytics executives we interviewed was the process of identifying siloed authoritative data systems (ADS) throughout the enterprise, and meeting with their owners to (a) agree to share their data and (b) define and deconstruct every data field to ensure it can be mapped correctly into the enterprise data repository.

Mapping the data, cleaning, and organizing it in the data lake

Once ADS SMEs have provided the CDO office with an in-depth understanding of the data tables, the data must be translated, mapped and matched to similar data in the data lake/repository using extraction, transformation, load (ETL) tools.³⁶ Industry leaders do

³⁶ <https://www.mulesoft.com/resources/esb/data-transformation>

utilize machine learning (ML) tools to automate extraction, cleaning and monitoring of high-quality data sets. This automated extraction process avoids mandatory legacy system sunsets as well as avoids the incurred cost of IT system standardization across silos. Interviewees suggested that where possible, data was migrated to the cloud and tools were used to clean, sort, and organize data.

Data Management

Establishing a data governance model

A data governance policy is a collection of rules that support the safeguarding of data and establishes standards for its access, use, and integrity.³⁷ Larger, private sector conglomerates do have more challenges with centralized approaches, since data are often defined very differently across entities. Although all the companies we interviewed had data governance in place, the larger organizations with vastly different operating divisions took a decentralized approach to data governance. This required local data management leaders to ensure that their authoritative data system had clearly defined data definitions that could be translated and mapped by enterprise ETL processes. For large conglomerates with semi-autonomous entities, the path forward is often to ensure the major entities adopt the single source of truth approach with clear and transparent ways to reconcile with enterprise data.³⁸ Establishing agency-wide data governance provides a baseline for data maturity assessments.

Data Policies

Data management policies will improve the organization's productivity and efficiency while ensuring compliance and safeguarding sensitive information. The following policies are typically found in data-mature organizations:

- Organizational authorities (*regarding data management*)
- Data Access



Current State in DoD

Comparably, DoD has more authoritative data systems (ADS) to source from than the average private sector transformation. There is a significant amount of work to be done here.

DoD has a lean, but capable analytics team that has internally developed an advanced analytics tool known as ADVANA. There are approximately 2,500 ADS inside DoD that need to be accessed and onboarded into the DoD data enterprise. DoD has onboarded 288 ADS at the time of this study. The ADVANA team is able to onboard 70 ADS every 90 days. Given the small size and lean nature of the ADVANA team, this progress is notable, but requires more resources to improve system onboarding. At this current rate, it will take the ADVANA team 7.9 years to finish the on-boarding of ADS. A focused budget increase could help them onboard all 2200 (remaining) systems in 2-3 years. A prioritized onboarding of the most critical ADS will ensure DoD achieves data maturity quickly.



Current State in DoD

DoD's organizational size and complexity do not lend itself to a centralized data governance policy. In fact, there is no single data governance policy that blankets DoD entities. This is congruent with best practices in the private sector. Extremely large, complex and diverse firms use a decentralized approach to data governance and DoD does this. Additionally, DoD has published the critical strategy documents and policy memos to facilitate implementation.

DoD's decentralized data governance efforts could be augmented by the Data Governance Playbook (resources.data.gov) issued by OMB that provides all federal agencies with not only policy standards, but templates, support and resources (CoE) to help establish them properly to satisfy the requirements of the President's Management Agenda. The CDAO and DoD Data Council must ensure that its components are adhering to federal standards.

³⁷ <https://www.sailpoint.com/identity-library/how-to-build-a-data-governance-policy/>

³⁸ <https://coe.gsa.gov/2020/02/14/da-update-8.html>

- Data Usage
- Data Integrity
- Data Integration
- Data Security & Handling
- Data Storage & Retention

It is important to note that having the right data policies has little impact on outcomes for the organization unless there is oversight and enforcement of the policies.

Platform development

Building the data analytics platform

The advancing nature and availability of cloud-based analytics platforms makes this process much easier than in recent years. Although some of the CDOs we spoke with took the time and effort to build an in-house analytics platform, others utilized an off-the-shelf (OTS) analytics platform with varied degrees of customization. A combination of mature 3rd party systems from major software providers or open-source tools are often used, but in most cases, customization and integration are needed to support the organization’s unique data sets. The corporations that purchased cloud-based analytics platforms argued that once their data was aggregated into a trusted, single source, it gave them the flexibility to switch platforms with greater ease as the technology evolved.

A lesson discussed by several companies was the importance of formally deciding on an analytics platform and sticking with it, even if it was not perfect. One company³⁹ recalled wasting years in deliberation in an effort to get 100% buy-in from all stakeholders, but the arrival of a new CEO ended the informed debate and a decision was made. The company suggested that the progress and benefits realized by the company after the introduction and company wide adoption of its analytics platform made it regret the extended deliberations on platform choice.



Current State in DoD

DoD has internally developed an advanced analytics tool known as ADVANA. Compared with the internally designed advanced analytics tools used by the companies interviewed, ADVANA’s capability compares well. The supporting effort to source enterprise data from DoD’s remaining 2200 ADS appears to be under-resourced

The ADVANA platform can be used in tablet format, which is the most commonly used interface for private sector ELT teams and their analytics. Tablet presentation format is currently used in senior DoD leadership meetings and the expanded use to lower levels will be an important factor in its successful reach across the enterprise.

Key Industry Finding #6

C-Suite metrics design should be based on the strategic plan, be reasonable in number, and be based on a top-down and bottom-up approach.

When corporations realize the need for a new metric or analytical requirement for a product, service or market condition, the metric design process begins in the business units. Organic analytics teams led by embedded SMEs from the CoE design the new metrics at the business

³⁹ Interview dated 10 Feb 2022

unit level. These metrics are designed in coordination with the CoE enterprise standards so that they can roll up with similar metrics at the enterprise level. Senior executives from corporations that successfully implemented metrics design suggested that the newly designed metrics and analytical views must be clearly mapped back to the enterprise strategic goals during the design phase.

The data analytics teams we interviewed indicated that they follow a process to create new metrics. Two different types of metrics were discussed that roll up into the executive analytics view include standard KPI metrics and Composite metrics.

Process to create standard metrics and KPIs:

- Start with a design strategy and ensure metrics map to it
- List the questions that need answers to build the metric
- Locate the data required to create the metric
- Review the data you need vs data you have
- Locate & source comparative data (competitor data & benchmarks)
- Assign owners for the data within metrics
- Ensure metrics are understood by business unit teams as well as adjacent and higher team in the organization⁴¹
- Communicate metric availability and importance
- Periodically review metrics to ensure they measure what matters and drive business performance

Organizations with analytics teams in each business unit are often empowered to evolve existing metrics or create new metrics as required to manage and drive improved business performance. Metrics find viability at the lowest levels and rise in reporting value as they translate into organizational composite metrics.

Process to create composite metrics

Composite metrics⁴² can be used by any organization with the need to roll up multiple, related metrics into a single broad indicator. Composite metrics can be either ‘Unit Weighted’, (i.e. each component received equal weight in the calculation of the mean) or ‘Regression-weighted’ (i.e. each component is weighted according to its factor loading). Regression-weighted scores were considered more technically valid and meaningful to the interviewees.

For example, a major technology firm with multiple creative sources of digital content needed to create a single composite metric that demonstrated (directionally) that content consumption was resonating with their global customer base. Each business unit was responsible for producing different kinds of digital content, but the purpose of the content was generally the same: to keep a user’s time and attention on their content vs competition. The technology firm created a composite metric that included multiple components (i.e. original content projects that have been completed and released for consumption). However, not all components inside a composite metric were considered equal. The firm assigned a weight to each component based, in this case, on the budget required to create the content.

⁴⁰ <https://bernardmarr.com/how-to-develop-effective-kpis/>

⁴¹ Some interviewees that led data analytics teams conducted road shows to promote the capability and functionality of new analytical views both inside and outside of their business units.

⁴² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5459482/>

Composite metrics receive more attention and usage inside large, complex organizations because they provide the ability to roll up hundreds, or thousands of related metrics into a single, directional view. One company executive suggested that composite metrics representing billions (\$) in sunk project costs are rolled up into a single metric coded green/yellow/red against acceptable internal thresholds. Executive leadership teams that use composite metrics to brief C-Suite and Board of Directors are able to significantly reduce and simplify the view which helps focus attention and decision making.

Regression-weighted composite metric	= 0.5*(proj A) + 0.4*(proj B) + 0.4*(proj C) + 0.3*(proj D)
Unit weighted composite metric	= mean (A, B, C, D)

For composite metrics to be effective, leaders have to understand the math behind the metric. They also have to understand the nuances behind the metric weights, data quality issues, and how the sensitivity of the variables in the individual indicators and overall composite metric.

Objectives and Key Results (OKRs)

Another, more strategically oriented, form of composite metrics, known as OKRs, is used at the higher echelons of an organization. OKRs are a useful goal-setting and leadership tool for communicating what an organization plans to achieve and the marks required to accomplish it. OKRs are used by about half of the companies interviewed with varying degrees of use beyond the top leadership levels. Most interviewees discussed using OKRs at the C-Suite and RBU leadership level.



Current State in DoD
 In terms of the design and introduction of new KPIs and composite metrics, DoD functions similarly to other large, complex organizations. Raw data is collected as close to the transaction/source as possible and metrics are created at the lowest business unit level. Metrics are pushed upwards and they roll up into larger, enterprise-wide views. The DSD’s executive dashboard view uses composite metrics which have the capability to drill down and decouple into the different sources and data that comprise the composite. This executive view and the use of composite metrics at the highest level is comparable to private sector best practices. The continued onboarding of data systems into ADVANA will help with transparency and the integration of component metrics into composite DoD-wide metrics.

OKRs are typically written with an Objective at the top and 3 to 5 supporting Key Results below it. For example, a business unit OKR might read as follows: “We will improve Market share by 15% as measured by 25% more products launched, a 15% improvement in marketing effectiveness, and an 80% customer retention rate.” Departments within that business unit (BU) would have their own set of OKRs that would link to the parent BU OKR. Most of the companies interviewed indicated that they have used the OKR method for over twenty years and the senior executives stated their OKRs created significant benefits, including clear goal setting, heightened communication, and a transparent organization-wide strategy.

(O)bjective	Achieve 15% growth in market share
(K)ey Result 1	Launch 25% more products this year
(K)ey Result 2	Improve marketing effectiveness by 30%
(K)ey Result 3	Retain 80% of existing customer subscriptions

There are some risks associated with combining related variables into a composite variable. These risks can include (a) lack of transparency (b) parts being actually representative of the whole (c) slight but meaningful differences among the parts and (d) choosing the right weight factor. Despite these risks, composite metrics are widely used to some degree by almost every organization that was interviewed. An organization's analytics team is accountable for the design, factoring, and risk management of composite metrics.

Use of Benchmarking

Each private sector company interviewed discussed the use of benchmarking when designing metrics. The practice of using benchmarks is implemented differently based on a variety of factors such as: (a) availability of peer competitors; (b) company performance in the marketplace; or (c) the company's ability to source benchmark data. One hi-tech digital content producer, who was interviewed for this study, found it too difficult to identify relevant and meaningful benchmarking data for the process of bringing new content to market so they instead focused their benchmarking efforts on the outcome desired, which was increased viewers and content consumption. While not all companies have clearly identifiable peers, organizations can break down a particular process to core functions that are commonly benchmarked. The hi-tech digital company worked with a 3rd party provider who specialized in obtaining benchmark data for multiple industries and functions.

A leading e-commerce retailer, who considered its market share and industry performance as best-in-class, acknowledged that benchmark data was useful to some extent, but not helpful for goal setting because their company exceeded all available external benchmarking data. This company, instead, chose to focus on benchmarking against internal performance and created stretch goals to strive for continuous improvement. The company's culture focused on digging deep into problems in search of excellence.

A dozen different companies interviewed said that they rely on quarterly Wall Street financial filings from their competitors to freely obtain benchmarking data. Many of these companies had dedicated business intelligence teams responsible for capturing, updating and leveraging this external data to shape company decision making. When available, companies also sourced benchmarking data from public records, and when not available, some companies said they relied on 3rd party data brokers to collect benchmarking data from industry players and anonymize the data for distribution. These companies typically measured themselves in quartiles against a wide spectrum of benchmarks and competitor data.

Presentation

Leading companies discussed the different mediums through which their executives consume their analytics. The majority of executive leadership teams, C-suites, and board members we spoke with discussed using cloud-based analytics platforms that were compatible with any viewing format. During quarterly board meetings or monthly C-suite meetings, executives were given an agenda of key metrics and discussion topics. This was done because only specific metrics that require senior team attention are briefed. Otherwise the expectation is that executives would review and be familiar with the other key metrics as well as the ones they were responsible for.

Executives, regardless of their location, (i.e. office, home, traveling) were able to pull up their dashboards and view company and RBU performance metrics. In cases where the data was sensitive, leaders had secure tablets they kept inside the office and brought to senior

leader meetings. In the case of a large technology company, leaders could access their personal dashboards from an app on their smartphone. Executive dashboards at this company were fully customized for the leader and their area of responsibility.

Periodicity

Each company interviewed offered insights into how frequently the senior team, including their board of directors, reviewed executive analytics. The recurring theme was that RBUs held weekly business operational metric reviews each week, while the company's senior team reviewed the composite key metrics for all RBUs every month. The Board of Directors reviewed their key metrics once per quarter. These review periods were flexible and several companies indicated that in times of market or company crisis, the periodicity of meetings became more frequent. The key to a well-functioning rhythm of meetings and reviews that cascade upwards to the top level is the linkage that high functioning companies put in place between their strategic goals and key metrics throughout the organization. Every key metric must contribute in some way towards the goal(s). With this linkage in place, metrics and data flows up and down the organization easily.

Review Cadence

Private sector best practices suggest that an organization should periodically review its metrics at each leadership level for (a) strategic relevance and (b) business insights.

Strategic Relevance reviews

Several CDOs indicated that although the business units and executive leadership teams made decisions on which metrics would be included in executive level views, the CDO Office was responsible for establishing a metrics review (once or twice per year) with business unit leaders and executive leaders. CDOs typically rely on the authorities of the CIO to establish and convene the annual or semi-annual metric review meetings.

During these meetings, many inputs are discussed to include market trends and risks, consumer & competitor behavior, government spending, geo-political factors, macroeconomic conditions, disruptive technology or platforms, and any changes to the company's strategic goals. Metrics are never eliminated, and the automated analytics programs continue to pull and store data for historical context and potential future use. However, there is an evolving nature to the executive analytics display that reflects a careful consideration of portent inputs.

Business Insight reviews

Business units typically reviewed metrics on a weekly basis, while ELTs and BoDs reviewed enterprise-wide metrics on a monthly and quarterly basis, respectively. The data analytics and the metrics business units produce are the key input for monthly ELT performance reviews.

Choosing metrics

Business leaders are familiar with the key metrics that drive business performance, so the chosen metrics don't often change. When they do change due to disruptions in the business environment or emerging opportunity, the metrics evolve and key stakeholders are notified. Organizations with advanced data maturity use automated monitoring with triggers and alerts to

signal to key stakeholders when certain thresholds are breached. These threshold breaches trigger the update (if needed) to the business unit dashboard for the upcoming business review so the threshold breach can be addressed.

Action outcomes

During these reviews, metrics that fall outside of normal expectations receive the majority of leadership focus. Organizations with advanced data maturity have analytics platforms that typically allow leaders to dive as deep as they want into the data behind displayed metrics until they reach causal factors. One major e-commerce retailer⁴³ said that the desire for leaders to dig deep into the ‘why’ behind red metrics was a cultural expectation. Further, it was suggested that once causal factors were identified, then a matrixed team of business analysts were assembled to investigate and provide recommendations for the next monthly review.

Key Industry Finding #7

Organizations with a trustworthy, single source of enterprise-wide data in place find that operational business improvements occur rapidly.

Although the journey from having basic analytics capability to advanced capability had varying delays for many interviewees, once the enterprise data was largely sourced, cleaned, mapped, and ready for use, the organizations began to see the benefits. These organizations began their journey by introducing analytics to establish quick, high value wins in key business units. Those wins were celebrated, and the effort was expanded to include other business units.

The CDOs we spoke with described a crawl, walk, run process to implementing data analytics across the enterprise, and this philosophy was previously discussed in the section on data maturity models. Organizations can spend years in the assessment and implementation phases to transform their company. The journey transforming the culture, talent, tools and data takes time. The successful execution of these key components of change slowly builds momentum and once the majority of data has been sourced from the authoritative data systems around the enterprise into a single source of truth, organizations can and will start to see rapid change. Companies described this capability milestone as a step function improvement for their organizations.

The most commonly discussed new capability was the use of artificial intelligence and more specifically, machine learning in their analytics. At the lowest level of introduction, machine learning can play an important and growing role to assist leaders at all levels of the organization detect abnormalities or predict failure by reviewing thousands of daily and real-time metrics and alerting leaders when metrics breach established thresholds. Companies

⁴³ Interview 7 Jan 2022

design this capability to not only monitor and alert them automatically but also provide likely reasons for failure based on machine learning algorithms. A technology services company⁴⁴ with equipment deployed at customer locations discussed their use of AI to constantly monitor performance data from each piece of field equipment. Regional and District field office managers received automated alerts via text or email that performance metrics on a specific piece of customer equipment was functioning outside the normal range.

Empowering the individual user

One of the steps near the end of the data maturity model is (analytics) self-service and employee empowerment. Companies that reach this level of data maturity have developed a culture and basic data literacy in the average employee that enables them to run their own analytic queries rather than relying on a centralized analytics team to satisfy their need. This can be a powerful shift in a company's culture and its business performance. Executives suggested that the presence of data driven decision-making tools in the hands of a broad range of employees results in faster decision cycle time and early problem identification.

In an environment where the public and private sector are both aggressively recruiting the same data savvy talent, the availability of advanced analytics to all employees creates several benefits for the organization. It can encourage the upskilling and development of non-technical employees into future data scientists. Additionally, this widespread availability engenders a sense of transparency and trust that the average employee has the tools and ability to run analytic queries that can make a difference for the entire company.

An executive⁴⁵ with a technology and media company suggested that their commitment to data transparency was a core part of their success. Their metrics can be viewed by anyone in the organization at any time, and much of this is real time data. When asked if widespread visibility to company-wide metrics would be a risk, the executive said no and that the benefits of this transparency were high. Employees view the data as an asset to make decisions, they trust it, and will cite the metrics that they are trying to influence before any meetings begin.

Trade-offs and Decision Analytics

Public and private sector organizations routinely make trade-off decisions such as reallocating capital or terminating a project in favor of something new. There are opportunity costs in every decision, and this is where senior executive teams have begun to use advanced analytics to measure and evaluate those costs. Senior leadership teams and shareholders often want and need to know that major decision making is creating the planned return on invested capital (ROIC). As a result, analytics teams have been asked to incorporate trade-offs and decision analytics into the suite of available reports.

A chief analytics officer for a major US Retailer⁴⁶ described their decision analytics process in terms of a wargaming exercise for RBU leaders. RBU leaders are asked to provide the analytics team with the major planned initiatives for the coming year that require tradeoff decisions (such as investing in R&D, introducing new products, opening/closing new locations, hiring/firing headcount, etc). Multiple scenarios are then run in the analytics

⁴⁴ Interview dated 7 Jan 2022

⁴⁵ Interview dated 26 Jan 2022

⁴⁶ Interview dated 24 Feb 2022

models with changing variables (weather, inflation, competitive presence, unemployment rate, etc.) to establish a baseline performance for the RBU for the coming year *provided* the RBU kept business operations the same as the previous year. Once this is completed, a baseline revenue projection is provided to the RBU. From there, and one by one, the RBU's planned trade-offs are introduced into the model and the analytics models estimate likely revenue change for each trade-off as well as the opportunity cost in the decision. In cases where the trade-offs created more revenue than maintaining status quo, the RBU sees a positive ROIC and moves forward with greater confidence as well as key variables to monitor.

Risk Analytics

Executives noted that regulatory and economic environments have become more challenging and the speed at which incidents make headlines has focused even more attention on improving risk management techniques. For senior executives, many risks are not easily identified, which results in instinctive risk mitigation, which delivers less than the required accuracy. As a result of this rising need to support this intuition with actual data, executives utilized their advanced analytics capability to help identify key risk factors before they become real. Risk analytics becomes a reality for organizations when they have access to the majority of, if not all, the authoritative data systems in an enterprise. Traditionally, risk management teams relied on the opinions (and intuition) of reporting business unit leaders to monitor, judge and report risk. With access to transaction-level source data in each reporting business unit, the analytics team can push massive amounts of data through risk algorithms.

According to executives, the main benefit of risk analytics was the newfound ability to create a fact-based starting point for measuring risk across the entire enterprise that brings multiple lines of risk into a centralized location. This centralized view provided executives with a wider, more inclusive perspective of emerging risks, confidence levels, and potential impact. Most companies indicated that they have had long standing enterprise risk management groups, but that implementing analytics into risk management provided clarity and perspective for the senior team.



Current State in DoD

DoD is analogous to the private sector in the sense that it does reallocate capital in its organization, often terminating projects in favor of another or reallocating budget from one organization to another based on need. DoD differs significantly from the private sector for several reasons to include (a) traditional measures such as revenue or profit are not available which make calculating opportunity cost very difficult (b) private sector timelines are compressed and intentionally quick due to shareholder expectations whereas DoD can wait years before knowing if a program is fruitful. Decision analytics can be useful for any organization, but DoD must identify more meaningful measures to evaluate opportunity cost of making different choices.



Current State in DoD

Private sector best practices have shifted a significant portion of the risk assessment workload from enterprise risk management (ERM) teams to advanced analytics teams that are dedicated to sourcing and reviewing large data sets (internally & externally) to identify and measure risk.

Although DoD has not yet completed its sourcing of ADS around the enterprise, it can benefit from the use of a risk analytics team to not only augment the risk management efforts conducted in each of the DoD's 33 components/agencies, but also use the component data to develop predictive analytics capabilities for DoD leadership to spot emerging risk.

A technology company⁴⁷ that often-used subcontractors to pre-assemble components, required access to the manufacturing data of each subcontractor. The company then used predictive analytics to mine through all the data to make predictions on which subcontractors would fail to meet their expected delivery deadlines. These predictions resulted in a high degree of accuracy of missed contractual targets, even though the subcontractors continued to promise an on-time delivery. This powerful insight enabled this company to predict the likely risk and make other arrangements to ensure impact was minimized.

A financial firm⁴⁸ used advanced analytics to automatically review hundreds of millions of transactions each day to identify patterns that may signal new fraud techniques. These new patterns were then incorporated into risk screening filters that enabled the company to instantly spot and freeze an account suspected of fraud.

Predictive analytics

During the course of interviews, several executives discussed their use of predictive analytics to address a large array of traditional challenges. Among others, this array included: competitive behavior, manufacturing yield, supplier reliability, and customer behavior. In several discussions, executives discussed the vast amounts of data their organizations produced and their intent to transform dormant, historical data into an asset that could enable them to anticipate future needs and opportunities.

Examples of predictive analytics were seen primarily in companies that had achieved a higher degree of data maturity. These companies had already gone through the process of sourcing data from authoritative data systems around the enterprise and pulled it into a trusted, single source for analytics. With a high-quality data source, companies were able to employ predictive analytics to find patterns in their data that signaled risk or potential opportunities. Predictive analytics can create significant improvement in business operations and the companies using it described it as a competitive advantage.

A large manufacturing company⁴⁹ with an automated assembly division used predictive analytics to determine when machines were about to break, the best days of the week to produce certain parts, the dependability of raw material suppliers, and which machines produced the least waste. Their ML models were even able to provide predictions on which shift employees produced less waste. The implementation of predictive analytics in this setting was a success and the company used it to internally message the benefits of advanced analytics.

An e-commerce retailer⁵⁰ used predictive analytics with its customer purchase behavior data to launch targeted marketing campaigns. For example, when a customer purchased items associated with a trigger event (i.e., wedding, newborn, graduation, etc.) the predictive analytics engines would look at other customer purchase behavior associated with similar events to anticipate the items that this particular customer would *most likely* need in the next 30, 60, or 90 days.

⁴⁷ Interview dated 7 Jan 2022

⁴⁸ Interview dated 14 Mar 2022

⁴⁹ Interview dated 14 Jan 2022

⁵⁰ Interview dated 7 Jan 2022

A digital content provider⁵¹ used predictive analytics to review customer behavior for content consumption patterns that could be used to anticipate other content the customer might enjoy. This company also used analytics to determine its customer viewing behavior to identify emerging trends in content searches. This enabled the company to anticipate and satisfy demand growth by planning resources against similar content.

A large technology firm⁵² mined through all of its employee related data and coupled this analysis with external market data to identify employees who were at high risk of leaving the company. This data included roles, skills, tenure, pay, and performance management data coupled with external market data that, when combined, created a risk profile. This profile indicated which high performing employees in a given role would merit a compensation package in the outside marketplace that was higher than their current role. This ability to predict at-risk employee attrition enabled the company to preemptively increase and normalize employee compensation packages to prevent unwanted attrition.

Prescriptive analytics

During a discussion, academic experts⁵³ referred to prescriptive analytics as the future of advanced analytics. While predictive analytics can be transformative for organizations as they gain insights into what *may* happen, prescriptive analytics takes this foresight, builds on it, and offers recommendations on *what* actions should be taken. Although robust use of predictive and, consequently, prescriptive analytics is seen in organizations with higher data maturity, the use of prescriptive techniques reinforces a culture of data driven decision making across the organization.

An executive at a major retailer said that as their predictive capability grew, their analytics teams naturally progressed into prescriptive analytics⁵⁴ for their RBUs. They became so adept at predicting financial performance for RBUs that they could advise them with a high degree of confidence what their revenue would be for the next four quarters if they took no actions outside of normal operations. The executive suggested that this predictive capability had to naturally evolve into a more sophisticated process where new scenarios could be introduced, and using AI tools on both internal and external data (such as customer behavior, weather patterns, competitor behavior, etc.), the analytics teams could make predictions about how, given the baseline prediction of future revenue, an RBU could incrementally improve its revenue beyond the baseline with low risk.



Current State in DoD

Organizations, regardless of sector, are able to effectively employ predictive and prescriptive analytics as they progress higher in data maturity. The opportunities for the application of predictive and prescriptive analytics seem endless at most private sector companies. DoD has similar opportunities for application. Its sustainment, support and procurement functions would benefit the most from predictive analytics capabilities. The limiting factor inside DoD to implement predictive and prescriptive analytics for each of the components is the required sourcing of data into the analytics platform. At the time of this study, DoD has not completed this data sourcing process. Increased resources in this effort would expedite the timeline predictive analytics could be realized across the enterprise.

⁵¹ Interview dated 26 Jan 2022

⁵² Interview dated 7 Jan 2022

⁵³ Interview dated 6 Jan 2022

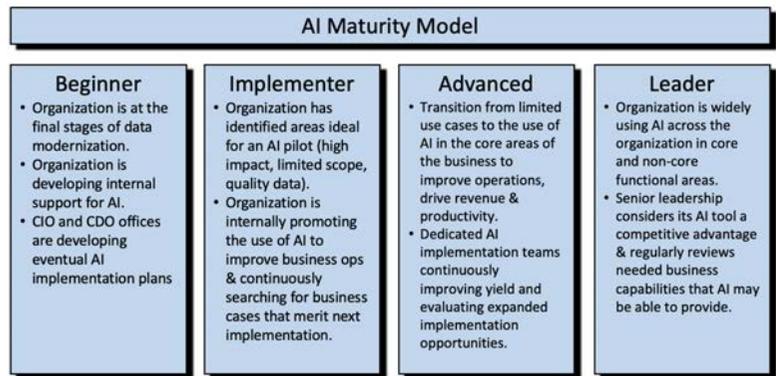
⁵⁴ Predictive analytics uses collected data to come up with future outcomes, while prescriptive analytics takes that data and those outcomes and offers potential paths forward to ensure the outcomes are desirable.

Application of AI/ML tools to drive business performance

Academic experts⁵⁵ have compared the introduction of Artificial Intelligence into the business setting to the introduction of electricity into business long ago. While businesses are just now beginning to explore new ways to leverage the technology, the potential applications seem limitless. There are some reliable and consistent applications that large organizations can follow to maximize its benefit.

Many of the companies we spoke with utilized AI and ML to improve their business decisions. It is important to note that all of the companies who considered themselves as effective and experienced AI users, also categorized themselves in the advanced stages of data maturity models. Academics⁵⁶ suggested that there is also a maturity curve in the use of AI which includes a natural progression from beginner to leader. As companies discussed how and where they decided to use these advanced tools, the suggestion was made that organizations interested in AI must think about the business capabilities they needed to acquire rather than technology needed. Executives discussed utilizing AI to address three different needs: (1) improved business insights, (2) automation of manual processes and (3) improving interactions with the customer.

The biggest opportunities discussed for many of these companies were not necessarily in cutting edge applications of AI in their business, but rather harnessing AI to gain efficiencies and create revenue opportunities using their existing, internal data. Executives discussed using AI to explore historical and current databases to improve back office business operations in functional areas that typically don't see a lot of reform initiatives such as: Customer experience, Accounting, Finance, Human Resources, and Procurement Management. Mini cases on each of these areas are discussed below.



Customer experience

A major retailer implemented an AI system that leverages the data from its in-store cameras to interpret customer traffic, monitor the length of checkout lines and the number of open registers.⁵⁷ These same tools monitor inventory and identify abandoned shopping carts in the store. When required, the AI systems notify managers for potential actions. Another major retailer uses AI to scan big data to determine when an existing customer is in proximity or within a geofence around one of their locations.⁵⁸ The AI system automatically sends a message to the customer with an offer to make a purchase.

⁵⁵ Interview dated 6 Jan 2022

⁵⁶ Interview dated 6 Jan 2022

⁵⁷ <https://www.supplychainbrain.com/blogs/1-think-tank/post/33047-can-big-box-retailers-take-on-e-commerce-with-ai>

⁵⁸ Interview dated 24 Feb 2022

AI systems such as this just sit on top of existing databases and continuously review data looking for patterns that either meet or fall outside normal thresholds. The applications of AI for organizations who would benefit from monitoring human traffic patterns, physical inventory, and automated customer interaction are extensive. Executives suggested that although it took years to get their enterprise data ready for AI tools, a return on investment for the implementation of AI⁵⁹ is not immediate, nor guaranteed. The difficulty in seeing returns is due, in large part, to the amount of capital that organizations have to invest in the lengthy journey of digital modernization and data driven cultural reinvention. Companies suggested that it took them up to 18 months to see ROI from AI implementations. However, the impact of automating previously manual tasks and freeing up employees to focus on more value-added activities create real benefits for an organization that may not be readily measurable in revenue or profit, but they are clearly helpful.

Accounting & Finance

A large consumer product manufacturer⁶⁰ discussed the significant impacts that AI tools had in modernizing and improving its accounting processes. With multiple dozens of separate financial entities and millions of financial transactions each year to review, the company sought to automate, as much as possible, the manual review and reconciliation of transactions. With its ability to use natural language processing,⁶¹ AI tools were able to help in areas such as reviewing financial transactions and spotting potentially fraudulent transactions. Other companies utilize AI tools to review contractual language and automate steps in financial audits. Some companies in the manufacturing space have begun to employ drones to hover above a manufacturing floor or inventory warehouse to count items in production or verify inventory counts without human involvement.⁶² The impact of AI applications like this for large legacy organizations with vast warehouses and millions of dollars in sitting inventory (that require counting for auditing purposes) is massive.

Human Resources

A technology and consulting company⁶³ viewed its employee talent as its greatest resource and as a result focused considerable attention on managing its employee data and human resource (HR) processes to ensure its people were developed, encouraged, and properly managed. The company suggested that the HR capability it needed most urgently was increasing the speed of HR decisions such as time to hire, time to fire, predicting employee attrition, and monitoring performance management. HR systems typically handle sensitive personnel data, and although AI helped the company improve efficiencies and reduce manual work, it found it difficult to remove the human interaction requirement. Although companies have found that AI powered chatbots can handle routine employee HR questions, employees expect to talk with a human when it pertains to their pay, performance, or benefits. However, AI can still play a significant role in improving HR functions. Among others, an

⁵⁹ <https://www.cognizant.com/us/en/whitepapers/documents/ai-from-data-to-roi-codex5984.pdf>

⁶⁰ Interview dated 14 Mar 2022

⁶¹ Natural language processing (NLP) is a branch of artificial intelligence that uses algorithms to interpret, transform and generate human language.

⁶² <https://www.journalofaccountancy.com/podcast/using-drones-to-enhance-audits.html>

⁶³ Interview dated 7 Jan 2022

implementation of AI tools on HR transactions yields benefits in talent acquisition, employee onboarding, personnel development, and recruiting.

Procurement management

Companies with large vendor bases providing raw materials, parts, service, or wholesale items are implementing AI tools to make their procurement process more efficient.⁶⁴ This is enabling

companies to see improvements in managing the following areas: spend analysis, contracts, vendors, category spend, anomaly detection, supplier risk, and accounts payable. An executive with a large manufacturing company⁶⁵ discussed the use of AI to monitor supplier risk. This automated insight enabled the company to anticipate supplier failures often before the supplier knew about the failure.

Companies have been able to apply AI tools to review and automatically classify all spend activity into categories and subcategories. Additionally they are now able to review millions of invoices and purchase orders to identify instances where the same vendor is being used by different divisions in the company.

Automation insights like this would enable companies to monitor commodity price fluctuations from vendors and identify opportunities to leverage enterprise spend to create discounted nation-wide pricing on the most frequently purchased commodities.

The use of advanced analytics tools such as artificial intelligence is most appropriate for organizations with a high degree of data maturity. Although some companies currently using AI tools also suggested that they had not reached the top of maturity models, their use of AI was limited to high impact, narrowly focused areas of opportunity.



Current State in DoD

DoD Data Strategy includes a guiding principle to ensure that data sets for A.I. training & algorithmic models are created & fostered. DoD considers these AI capable data sets as one of its most valuable digital assets.

The (new) office of the CDAO merges formerly independent departments inside DoD: the Joint Artificial Intelligence Center (JAIC), the Chief Data Officer (CDO), the Defense Digital Service (DDS), and the ADVANA team. The CDO handles data management & coordination, the DDS finds digital solutions for data & security issues, & ADVANA aggregates data and conducts data analytics.

DoD has leaned forward in the development of its AI capability with the JAIC. From a strategic and functional perspective, the JAIC was tasked and resourced appropriately to explore opportunities for AI application across the components. Utilizing the JAIC's ability to pursue areas of high-impact, limited scope, and quality data, the office of the CDAO will be able to better leverage the value of DoD's data to achieve its NDS goals.

Despite this solid positioning, DoD's ability to leverage AI across the organization is dependent on its ability to (a) access data & (b) coordinate the deployment & use of AI tools.

From a private sector perspective, the chokepoint in expanding the deployment and use of AI inside DoD is ADVANA's ability to access and onboard ADS data quickly.

⁶⁴ <https://sievo.com/resources/ai-in-procurement>

⁶⁵ Interview dated 14 Jan 2022

Recommendations and Possible COAs

A partial effort to implement the key findings from this study is not enough to realize the wide-ranging and necessary benefits of a fully functioning enterprise data analytics program. Current and future DoD leaders must ensure this transformational effort in data integration and analytics is implemented in a durable and lasting manner that survives DoD leadership transition and embraces future technologies. Establishing best-practice standards for governance, analytics tools, culture change, and organizational structure creates a reference point for DoD to identify the degree of change required.

Private sector best practices on the implementation of recommendations such as those that follow would typically include ‘as measured by’ metrics or milestones. This insight is intended to help senior and lower level DoD leaders understand how the implementation of these recommendations will be measured.

Assessment & Planning

1. **RECOMMENDATION** The CDAO and CDO council must direct components to perform an assessment of the maturity of the data analytics strategic alignment, capabilities, resources, culture, and the organizational structure utilizing standard maturity models. Assessments enable the creation of a time and resourced-phased plan informed by the integrated results. Robust cultural change management is a critical-to-success element of the plan.

Organizations in the private sector perform assessments in key areas of their company to help them understand the degree of effort, time, and resources required to digitally transform. The assessment phase involves the following areas: Strategic, Capabilities, Resources, Culture, & Organizational Structure. An organization’s understanding of its current capability will dictate the lift needed to affect impactful change. The plan includes a change management approach to address the required cultural shift. The assessment phases can be performed simultaneously. The subsequent planning required after each area of assessment involves the identification, prioritization and resource phasing of implementation.

Two assessment areas in particular have considerable impact on successful implementations: (1) the strategic assessment and more specifically, the alignment of executive analytics to strategic goals and (2) the culture assessment and establishing the baseline of what behaviors, mindsets and specific roles need attention.

DoD policy and strategy documents recently issued are necessary to direct and shape its digital transformation. However, DoD’s data integration and progression is slow moving. The private sector’s data progression reveals the value in performing effort, time, and resource assessments. Through assessments, DoD can establish baselines against the desired future state and measure progress while closing the capability and performance gaps that will certainly differ among the 33 DoD components.

The cultural recommendations included here are key areas of the required cultural shift focused on performance management, but a broader effort of cultural change requires a larger and more inclusive effort.

Compliance

2. **RECOMMENDATION** The CDAO through the Data Council must ensure measurable component/agency progress of DoD's Data Strategy Implementation Plans is collected and reported up to the DSD level for review each month.

Private sector CDOs closely monitor the progress of RBUs on their implementation plan for data strategies. During this study, it was suggested that regular reporting to the C-suite on RBU progress was a key lever in closing performance gaps.

The DSD's memo and DoD's Data Strategy establishes a desired set of data analytics capabilities for all organizations under DoD. Overall, if/when compared to industry standards of organizations with the same size and complexity, DoD's enterprise data analytics capability sits at a low to mid-level stage of maturity. However, pockets of analytics excellence in various organizations exist within DoD's "siloes" analytics platforms.

According to the DoD's Data Strategy, DoD Components are responsible for developing measurable Data Strategy Implementation Plans, which are overseen by the DoD CDAO and DoD Data Council.

DoD's challenges include: (a) continued visibility on the progress being made by each component; and (b) create accountability for components as they comply with the Data Strategy directives.

3. **RECOMMENDATION** DoD must review existing ADVANA data sharing policies to consider revising data sharing requirements from the Services, COCOMs, DAFAs and Agencies to include: (a) clarifying requirements for transactional data access; (b) establishing compliance dates; and (c) reporting compliance up to the CDAO and DSD level.

We spoke to a number of CDOs inside DoD about analytics platforms used by specific Services and Agencies about their multiple analytics platforms. For example, the Army has 'Vantage', the Navy has 'Jupiter', the USAF has 'Blade'. Based on conversations with Service's CDO, their system appears to satisfy the analytical requirements of their respective owners. While the Services' CDOs acknowledge the ADVANA tool and data sharing policies, it does not appear there is any intent to sunset their existing platforms and migrate to ADVANA. From our study, the Services and Agencies with their own analytics platforms may prefer to share aggregated data with ADVANA rather than raw, transactional data.

From our discussions with private sector C-Suite executives, their RBUs with "siloes" analytic platforms also preferred to provide aggregated data rather than raw transactional data, however, the raw transactional data is what is required for current and any future fielded platforms. Private sector CIOs and CDOs indicated that policy clarifications were necessary to ensure that their RBUs shared raw transactional data before aggregated data.

Organizational Structure

4. **RECOMMENDATION** DoD must increase the speed of its progress with onboarding authoritative data systems (ADS) into the enterprise analytics tool (i.e., ADVANA). The CDAO or CIO must allocate appropriate resources to the ADVANA team to increase their current onboarding of the remaining ADS (i.e., 2,200) within the next 2-3 years. In addition, ADVANA must prioritize

ADS onboarding and focus on the most critical systems and metrics relative to measuring NDS goals and priorities.

At the time of this study, the ADVANA team onboarded 288 of 2500 ADS (11.5% completion rate). Given its current resources, ADVANA is able to onboard 70 ADS every 90 days. Given the small size and lean nature of the ADVANA team, this progress is notable, but too slow considering the importance and urgency. At this current rate, it will take the ADVANA team 7.9 years to finish the on-boarding of all DoD's ADS.

5. RECOMMENDATION DoD must disseminate analytics SMEs into its components/agencies faster. The CDAO's analytics Center of Excellence (CoE) has 20 SMEs. However, given the size and scope of DoD, it should have at least 100 to handle all of DoD's 33 components. An increase in data SMEs must occur within the next 12-24 months to populate the critically important (embedded) analytics SMEs needed in each of the components. This will improve DoD's progress towards data strategy and analytics implementation to remain competitive with peer competitors.

DoD faces some challenges in organizing and implementing a federated data analytics model. These challenges involve the existing organizational culture, funding prioritization, and available talent.

While the DoD CDAO currently includes a CoE⁶⁶ for analytics, DoD does not compare to the private sector in size. DoD is currently only staffed with 20 data scientists who are currently embedded in each COCOM HQ. The size and current scope of this CoE, however, appears to be a function of an initial deployment phase. Based on private sector best practices and the number of DoD components, the size and scope the CoE will need to grow exponentially. It is important to differentiate the necessary effort to create a world-class CoE versus lifting the data talent and skills of all employees.

Culture / Skills Development / Performance Management

6. RECOMMENDATION DoD must create internally funded certification programs and CoE apprenticeships to upskill and reskill DoD civilian employees to improve data literacy and create an organic source of certified data scientists and analysts. Existing employee talent must be harnessed to make progress in DoD's digital transformation.

The private sector assesses its talent, tools, and budget when evaluating resources to implement analytics capabilities. The DSD Memo⁶⁷ (dated 2/1/22) established the authority for the CDAO to utilize special hiring authority to recruit necessary talent for data management & analytics. In addition to its aggressive recruiting efforts, the private sector also builds in the ability and means to reskill existing employees, simply because the recruiting process is so costly and time consuming.

Talent is the most constrained resource required to implement data analytics inside DoD. Recruiting the right talent is a regular topic of conversation inside DoD, and as a result, there are several current and ongoing recruiting initiatives. However, there are limited programs or initiatives to incentivize existing DoD employees to upskill or re-skill with

⁶⁶ DSD Memo (dtd 12/10/20) Establishes a Senior Leader Decision Support element as the body that will integrate enterprise data analytics into senior leader decision forums, processes and governance. For Executive Analytics, the body will recommend analytic priorities, establish standards, definitions, goals, KPIs for areas of analytic importance AND be the overall process lead to deliver Executive Analytics.

⁶⁷ 5 CFR §213.3102(r). Ability to use special hiring authorities, through appropriate human resources support organizations, to include Excepted Service Schedules in part 213 of title 5 of the Code of Federal Regulations (CFR), as well as the Cyber Excepted Service in title 10, U.S. Code, section 1599(t)

regards to data analytics. If DoD needs to source data scientists, data engineers, and data analysts, but faces challenges competing with the private sector, the implementation of an Upskill/Reskill program could be a viable alternate path.⁶⁸ Aside from formal certifications in data science and analytics, most DoD employees would benefit from a basic level of analytics training that develops skills to use the analytical tools, understand statistical significance, and interpret data correctly.

7. RECOMMENDATION DoD should direct the DBB to perform a supplemental study of how DCHRMS and other DoD performance management systems can be used or modified to adopt private sector best practices into its performance management systems.

A skill-based inventory system could transform DoD's culture by providing increased insights into employee skills, knowledge, and willingness to learn new emerging technology. Tracking employee skills and certifications is a key-lever that private sector employers use to transform into a data driven culture. In the private sector, an interactive platform pushes recommendations to employees about evolving requirements for their position (i.e., languages, certifications, etc.) that will help increase their chances for promotion and greater pay. DoD's DCHRMS or other current DoD performance management systems may provide a similar capability that aligns with the private sector's best practices of keeping a skill-based inventory system for all employees.

The suggestion of a supplemental study is intended to shed additional insights on other tools inside DoD that could be helpful in a successful implementation of enterprise-wide analytics. DoD should press forward with recommendations in this study, but would also benefit from understanding how to better leverage its performance evaluation systems.

8. RECOMMENDATION Senior DoD leaders and their organizations should be measured on their use of existing authorities and administrative processes to manage poor performing employees. Interviews with DoD DHRA staff indicated that these authorities are not used frequently due to perceptions of difficulty. Existing authorities serve to correct and foster improved employee performance. Cultural transformation requires the ability to shape behavior and off-board employees unwilling to help in the transformation. In cases where existing authorities are insufficient to process poor performers, seek additional authorities.

To ensure enterprise-wide transformations have a high probability of success, talent and culture are key factors. Organizations that can leverage performance management and evaluation systems to shape new behaviors and off-ramp employees who are not able to make cultural shifts is critical. Employees with the right talent and mindsets must buy-in and be 'on the bus' to become a part of the cultural change necessary to transform the organization. There is some concern that DoD may find it difficult to handle employees who are not willing to make necessary behavioral or skill set changes as roles evolve during digital transformation. DoD's lack of key technology talent is a national security concern. Statistically, employees in the private sector have a 6%⁶⁹ chance of being fired each year, but for DoD civilian employees, the chances are twelve times lower (0.47%⁷⁰) that they will

⁶⁸ DoD's hiring process takes 6-8 weeks on average. Private sector avg is 23 days.

<https://www.volckeralliance.org/sites/default/files/attachments/Final%20Report%20-%20National%20Commission.pdf>

⁶⁹ Work Institute. 2019 Retention Report. Pg 4. <https://www.info.workinstitute.com>

⁷⁰ <https://www.govexec.com/feature/firing-line/>

lose employment due to poor performance. Interviews suggested that a mix of administrative and legislative constraints inhibits DoD's ability to leverage workforce performance evaluation systems to effectively shape behaviors and off-ramp, where necessary, the employees unwilling to meet change.

DoD does have administrative processes in place to support, develop, and if necessary, off-ramp poor performing employees. However, interviews with some DoD leaders responsible for performance management systems indicated that the process was long, arduous, and time consuming for a manager.⁷¹ There is an opportunity for DoD to step up the effort to use existing authorities more frequently and more effectively. This would provide DoD the flexibility it needs to reshape its (current) workforce into what it requires for success.

Periodicity/Review

9. RECOMMENDATION The DSD should direct the Defense Business Council (DBC), to include an external perspective on emerging competitive, economic and logistical trends in its quarterly assessments to the Deputy Management Action Group (DMAG).⁷² The external perspective will augment the input from DoD components on the changing defense environment versus the metrics used to measure progress on NDS goals and priorities. The purpose of this assessment is to make recommendations on how ADVANA's current Executive Analytics display should adapt to changing conditions and inform DoD senior leaders more acutely on emerging issues. These recommendations should be presented as part of the DBC's quarterly update to the DMAG.

Private sector executive teams have established a review cadence of their key metrics. This review is crucial because it is a process that includes views and analysis (from outside the company) as well as views from inside the company on marketplace patterns, competitor behavior, consumer trends, and emerging disruptors. The periodicity of these reviews varies depending on the leadership level. At the highest levels, companies review their key metrics for relevance semi-annually. At the RBU level, business units may review them quarterly. However, indications that require new metrics and warnings that old metrics need adjustment typically originate from lower levels that are closest to customer transactions. Depending on the urgency, metrics of concern are pushed upward for semi-annual review at an enterprise level.

*At the DSD level, DoD typically reviews its business metrics weekly.⁷³ In addition to the operational review of business metrics, the DSD has advisory councils that support the governance and vetting of business issues for consideration by the DMAG. One of these advisory councils is the Defense Business Council (DBC).^{74, 75} The DBC's charter indicates that it is responsible for improving DoD's business operations to include a review of metrics based on internal perspectives from DoD's components. The opportunity to improve this process exists in adding external (to DoD) perspectives on emerging the augmentation of this review of existing ADVANA (executive analytic) metrics against the metrics DoD leaders **should** be looking at based on marketplace patterns, competitor behavior,*

⁷¹ Interview dated 29 Mar 2022

⁷² <https://media.defense.gov/2021/Mar/11/2002598613/-1/-1/0/GOVERNANCE-STRUCTURE-FOR-DEPUTY-SECRETARY-MANAGED-PROCESSES-FINAL.PDF>

⁷³ *ibid*

⁷⁴ <https://dam.defense.gov/Resources/Defense-Business-Council-and-Investment-Management/>

⁷⁵ https://dam.defense.gov/Portals/47/Documents/Governance/DBC_Charter_12122014.pdf

consumer trends, and emerging disruptors that DoD component leaders do not have visibility to.

AI/ML Implementation

10. **RECOMMENDATION** As the Data Strategy Implementation Plan is matured, the department would benefit from an investigation on how the private sector is implementing higher tier analytics such as AI/ML to transform business operations, and leveraging best practices in governance.

The DoD's Data Strategy requires DoD Components to develop measurable Data Strategy Implementation Plans, which are overseen by the DoD CDO and DoD Data Council. Once these plans are complete and the CDAO has a landscape view of how, when, and what data strategy implementation will occur in each component, a review to coordinate the implementation of AI/ML tools is appropriate. The creation of the office of the CDAO merges formerly independent departments inside DoD (the Joint Artificial Intelligence Center (JAIC), the Chief Data Officer (CDO), the Defense Digital Service (DDS), and the ADVANA team). This provides the CDAO with an ideal vantage point to review and coordinate all opportunities for AI implementation.



Linnie Haynesworth
Subcommittee Chair



David Bitel
Subcommittee Member



Oscar Munoz
Subcommittee Member



David Van Slyke, PHD
Subcommittee Member



GEN Joseph Votel USA (Ret)
Subcommittee Member



Hon. David Walker
Subcommittee Member



Saf Yeboah-Amankwah
Subcommittee Member



Defense Business Board

TAB A

TERMS OF REFERENCE



DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, DC 20301-1010

NOV 05 2021

MEMORANDUM FOR SENIOR PENTAGON LEADERSHIP
COMMANDERS OF THE COMBATANT COMMANDS
DEFENSE AGENCY AND DOD FIELD ACTIVITY DIRECTORS

SUBJECT: Terms of Reference – Executive Analytics for Defense Business Operations

Enterprise-wide business reform is a key Department priority. I issued a memorandum, “Creating Data Advantage,” on May 5, 2021 with the intent to transform the DoD into a data-centric organization.

While I am encouraged by the progress DoD has made cataloging and ingesting data, we must continually evaluate industry best practices to determine how they might benefit the DoD. Therefore, I direct the Defense Business Board (“DBB” or “the Board”) through its Business Transformation Advisory Subcommittee (“the Subcommittee”) to examine how C-suite and business unit-head-level private industry leaders leverage enterprise-level data and analytics to inform decision-making and maximize the efficacy and effectiveness of their business operations. Specifically, the Subcommittee will focus on:

- Identifying world class, private industry best practices to integrate metrics, benchmarks, and targets used to manage business operations to concretely identify areas for performance improvement, quantify risks and trade-offs, and validate the impact of strategic choices;
- Identifying best practices and existing gaps in how private industry sets, reviews, and oversees its quantitative analytics priorities;
- Developing specific recommendations for managing enterprise business operations including presentation, periodicity, organizational level reviews, use cases, and approaches to apply these best practices to Deputy Secretary decisions and responsibilities; and
- Any related matters the Board determines relevant to this task.

The Subcommittee’s findings, observations, and recommendations will be presented to the full Board for thorough open discussion and deliberation in a noticed public meeting subject to the Government in the Sunshine Act. The Board will provide its final findings and recommendations to me no later than May 31, 2022.

In conducting its work, the Board has my full support to meet with Department leaders and all requests for data or information shall be honored that may be relevant to its fact-finding and research under this Terms of Reference. As such, the Office of the Secretary of Defense and DoD Component Heads are requested to cooperate and promptly expedite requests by Board staff regarding access to relevant personnel and information deemed necessary, as directed by



paragraphs 5.1.8. and 5.3.4. of DoD Instruction 5105.04, "Department of Defense Federal Advisory Committee Management Program," August 6, 2007, and in conformance with applicable security classifications. Components should respond to requests for data/information from the Board within five business days.

Specifically, I direct the Under Secretary of Defense (Comptroller)/Chief Financial Officer to provide support to the Subcommittee in accessing and working with ADVANA and its executive analytics platform on an as-needed basis until the study is completed. Material provided to the Board becomes public record and is considered a permanent part of the Board's records.

Components are reminded that all data/information provided is subject to public inspection unless the originating Component office properly marks the data/information with the appropriate classification and Freedom of Information Act exemption categories before the data/information is released to the Board. The Board has physical and electronic storage as well as communications capability on both unclassified and classified networks to support receipt of material up to the Secret level. Components should remember that Board members, as Special Government Employee members of a DoD Federal Advisory Committee, will not be given any access to the DoD Network, to include DoD email systems.

The Subcommittee shall not work independently of the Board's charter. The Board and the Subcommittee will operate in conformity with and pursuant to the Federal Advisory Committee Act, the Government in the Sunshine Act, and other applicable Federal statutes and regulations. The Subcommittee and individual Board members do not have the authority to make decisions or provide recommendations on behalf of the Board, nor report such directly to any Federal representative. The members of the Subcommittee and the Board are subject to certain Federal ethics laws, including 18 U.S.C. § 208, governing conflicts of interest, and the Standards of Ethical Conduct regulations in 5 C.F.R., Part 2635.

Thank you in advance for your cooperation and support to this critical undertaking to inform subsequent decisions on how the Department addresses national security challenges in the coming decades. My points of contact for this effort are Colonel Chuck Brewer, USMCR, DBB Military Representative, at (317) 918-5454 or charles.w.brewer3.mil@mail.mil, and Ms. Jennifer Hill, Executive Director/Designated Federal Officer, DBB, at (571) 342-0070 or jennifer.s.hill4.civ@mail.mil.



cc:
Chair, Defense Business Board



Defense Business Board

TAB B

Defense Business Board Presentation, May 12, 2022

Exec Analytics in DoD & a Review of Private Sector Best Practices

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Assessment of Executive Analytics in Department of Defense and a Review of Private Sector Best Practices

12 MAY 2022

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Executive Summary

Private sector firms live or die with their ability to harness and leverage their data to gain a competitive edge in the marketplace.

DoD is large and complex, but it's situation is very similar to many of the large, complicated private sector firms we interviewed prior to their own digital transformations.

The effort to source data, on-board new tools, transform culture and upskill employees is challenging, and many private sector firms referred to the implementation of enterprise-wide executive analytics as a long but rewarding journey.

DoD's recent policy changes involving data strategy, digital modernization, AI/ML, and the CDAO reporting structure all demonstrate strong alignment with the private sector key findings in the study.

While DoD has made real progress in setting up the organization with the tools, policies, and structure to build an executive analytics capability, compared to the private sector, DoD has a long way to go on two fronts: data culture transformation and timely sourcing of enterprise-wide data.

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Subcommittee



David Beitel
Chief Technology Officer
Zillow Group



Linnie Haynesworth
Former VP Northrop
Grumman &
Independent Board
Director



Oscar Munoz
Retired Chairman,
President & CEO
United Airlines



David Van Slyke, PhD
Dean, The Maxwell School of
Citizenship & Public Affairs
Syracuse University



**GEN Joseph Votel
USA (Ret)**
President & CEO
Business Executives
for National Security



Hon. David Walker
Former U.S. Comptroller
General



**Saf Yeboah-
Amankwah**
Chief Strategy Officer
Intel Corporation

Listed alphabetically

The subcommittee members have an ideal blend of skillsets and experiences to engage with private sector leaders and create recommendations that translate into DoD application. This expertise includes the areas of:

- Management consulting
- Cultural transformation
- Organizational design
- Information Technology
- Federal Government
- Department of Defense

DBB Staff

Col Chuck W Brewer USMC
CAPT Daryl M Wilson USN
COL Rich Sudder, USA
Ms Leah Glaccum
Ms Cheyenne Rodriguez

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Task & Observations

Study Objective: Examine C-Suite Use of Enterprise Analytics for Decision Making



Terms of Reference
5 Nov 2021

Specifically:

- Identify world class, private industry best practices to integrate metrics and benchmarks used to manage business operations
- Identify best practices in how private industry sets, reviews, and oversees its quantitative analytics priorities;
- Develop specific recommendations for managing enterprise business operations

Goal: Develop recommendations to manage enterprise business operations and risks

Organizations don't implement enterprise-wide executive analytics overnight.

- Phased approach - crawl-walk-run to increase data maturity where analytics have maximum impact for senior leaders.
- Requires considerable thought, planning, and effort to source and integrate the organization's data.
- ***This process was a journey for each of the companies we interviewed***

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Interview process

34 C-Suite leaders from Fortune 500 firms, 14 senior (former & current) DoD leaders.

Selection Criteria:

- Reputation for using enterprise level analytics
- Range of firms by industry, scale, age, resources
- Required a cultural shift to successfully implement

Executives shared their best practices in using executive analytics and described the long and difficult journey their company went through to build their analytics capability.

Interview questions were derived from TOR mapping with the following themes:

- Development, design and implementation and review of integrated metrics and KPIs
- Use of internal and external metrics to drive decision making and benchmarking
- How metrics are used to predict or identify risk
- Overall prioritization of analytics (including funding)
- Strategic goals and incentives/performance measurement linkages for employees
- Format for presenting/communicating metrics to senior leaders (dashboard, real time data)
- Lessons learned and celebrated use cases from transitioning to an integrated metrics environment

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Results

The steps in this common journey have been captured and presented at a high-level to demonstrate how DoD compares in this journey.

Private sector best practices in implementing executive analytics involved two phases: (1) **assessment/planning**; and (2) **implementation**.

The Assessment/Planning phase:

- Strategy
- Capabilities, Resources & Culture
- Organizational Structure

The Implementation phase:

- Cultural change
- Data Management
- Metrics design
- Leveling up

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Key Findings

Recurring themes emerged from these two phases that we believe are significant for DoD. We have identified these as **key findings**.

The Assessment/ Planning phase

- Strategy
- Capabilities, Resources & Culture
- Organizational Structure

The Implementation phase

- Cultural change
- Data Management
- Metrics design
- Leveling up

Key Findings

1. Strategic goals drive the selection of enterprise-wide objectives and C-suite metrics.
2. Current capabilities, resources, and culture determine the best path forward for a enterprise-wide implementation.
3. Federated organizational models offer the authority to enforce data governance & analytics standards across the enterprise.
4. Cultural changes required to link key metrics to incentive systems and prepare teams for new tools, capabilities, and skill demands.
5. Data sourcing & data management fuels the analytics engine.
6. The strategic plan drives C-Suite metrics design and incorporates a top-down and bottom-up approach.
7. Capability improvements, particularly using artificial intelligence, occur rapidly for organizations once they complete data sourcing

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Key Finding 1

Strategic goals drive the selection of enterprise-wide objectives and C-suite metrics.

Best Practices

C-suite **reviews** its **metrics** for relevance against corporate strategy, market conditions, opportunities and potential disruptors and adjusts executive level metrics as appropriate.

C-suite metrics are **reasonable in number** (typically 8-12) and considered by leaders at all levels as their 'north stars.' These metrics clearly map to the organization's strategic goals.

An organization's **business goals** and the levers that influence their movement **dictate the metrics** viewed by the C-suite

Individual business unit leaders ensure that their key metrics tie in and contribute to the organization's top business goals.

DoD comparison

DoD publishes its National Defense Strategy and more specifically, its organizational goals (approximately) every four (4) years, which is comparable to the long term (3-5 yr) strategy of the private sector.

DoD's executive view in ADVANA includes six (6) metrics.

These six metrics all tie into NDS goals and priorities.

Component leaders are aware of NDS goals and priorities. Some components push relevant metrics up to ADVANA although some metrics do not yet include goals.

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Key Finding 2

Current capabilities, resources, and culture determine the best path forward for a enterprise-wide implementation.

Best Practices

Organizations use **data maturity models** to assess the (current) capabilities across the enterprise.

Organizations **assess the resources** required to ensure a successful implementation of analytics. This includes:

- Money
- Tools
- Talent

Organizations **assess their data culture** to understand how significant the shift will be to change employee behavior to include data driven decision making.

DoD comparison

Senior leaders in the CDO Office are familiar with data maturity models and DoD can compare to a good mid-level position on the data analytics maturity model. DoD CDAO must receive periodic updates on the data maturity levels for each component. There are pockets of (data) excellence inside DoD where advanced analytics can and are being utilized.

DoD has built an effective and capable advanced analytics platform (ADVANA) and designated it as the single, trusted source.

DoD leaders recognize the need to not only attract and recruit data literate talent, but must also recognize the opportunity to reskill / upskill existing DoD employees to meet the growing need.

DoD leaders responsible for the digital transformation of DoD would benefit from an opportunity to baseline existing data culture in different components.

Acronyms: CDO is Chief Data Officer, CDAO is Chief Data & Artificial Intelligence Officer
ADVANA is DoD's ADVanced ANalytics platform

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Key Finding 3

Federated organizational models offer the authority to enforce data governance & analytics standards across the enterprise.

Best Practices

The majority of C-Suite executives interviewed stated that they redesigned their data organization with a **federated model**.*

Organizations implemented an **analytics center of excellence (CoE)** that establishes governance and provided analytics support to business unit leaders using embedded analytics SMEs tasked with (a) empowering decision-making with analytics; (b) training business unit staff to use analytics; (c) following governance models; (d) ensure that business unit analytics map to enterprise goals.

Organizations leverage the CoE's embedded analytics experts to help business units **prioritize their analytical needs**.

DoD comparison

DoD's organizational structure uses a decentralized data governance model for execution. As its CoE matures, DoD can adopt a federated model.

DoD does have a nascent analytics center of excellence and trains its users on the ADVANA platform. The ADVANA CoE has 20 SMEs that are embedded with COCOM leaders with the primary mission to empower decision making with analytics.

With only 20 embedded SMEs inside DoD (currently limited to COCOMs); all other components self-manage their analytics priorities.

* A **federated** structure organizes data analytics for the enterprise with a central hub responsible for governance functions and still allows business units to tailor analytics to their specific needs. In a **centralized** structure, responsibility for execution of analytics & governance authority are concentrated in a HQ unit. Analytics requests are received and prioritized based on importance. A **decentralized** structure distributes data analytics authorities & responsibilities to business units. This provides them with autonomy and no expectation for coordination.

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Key Finding 4

Cultural changes are required to link key metrics to incentive systems and prepare teams for new tools, capabilities, and skill demands.

Best Practices

A data driven cultural change **starts at the very top** of an organization.

Leaders adopt, propagate and encourage new mindsets such as **'Embrace the Red'** in pursuit of stretch goals and learning.

Organizations create a clear **linkage between C-suite metrics and employee performance measurement & reward systems**. This cascades down through the organization.

Change management principles in use in each Reporting Business Unit.

DoD comparison

Senior DoD leaders have begun to establish directives & behavioral norms that require the use of a trusted single source of data. DoD component leaders must all recognize and lead their own data cultural transformation. DoD leaders can do more to improve their embrace and tolerance of red metrics, provided decision making is data-driven.

Personnel supervisors inside DoD do have authorities to manage poor performers but there is some indication that these authorities may not be used enough. DoD Managers should be encouraged to use existing authorities more and request additional authorities as necessary.

DoD has several internally designed performance evaluation & management systems. There is some capability to link NDS goals to individual performance evaluations, but these systems & their capabilities requires further study. DoD would benefit from a private sector best practice of implementing a catalog that tracks employee skills & certifications.

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Key Finding 5

Data sourcing & data management fuels the analytics engine

Best Practices

Organizations focus resources on **sourcing data** from disparate systems into enterprise repository. Aside from cultural transformation, this is main effort.

Organizations dedicate resources to establish data sharing agreements and sit with system SMEs to understand the data architecture to ensure proper **data mapping**.

All successful implementations include strong **data governance and policy** models. Large & complex organizations establish governance standards and rely on a decentralized adoption and implementation. Oversight and enforcement is centrally monitored.

Organizations either build internally or buy their **analytics platforms** based on business needs. Customization is always required. Cloud-based platforms are preferred, but some use a hybrid approach.

DoD comparison

DoD's ADVANA team is 11.5% complete in its on-boarding of 2500 data systems. At the current on-boarding rate, this process will take 7.9 years.

DoD's ADVANA team spends considerable time with system owners to familiarize, translate and on-board. ADVANA has data sharing agreements that require occasional clarification and enforcement.

DoD has published the appropriate data policies and utilizes a decentralized data governance execution model (with centralized oversight). DoD's Data Strategy requires components to develop and execute their own Data Strategy implementation plans. This is a critical step that requires progress reporting and CDAO visibility.

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Key Finding 6

The strategic plan drives C-Suite metrics design and incorporates a top-down and bottom-up approach.

Best Practices

Requirements for new metrics can originate from the C-suite (top down) or business unit level (bottom up). Organic analytics teams led by embedded SMEs **design** the **new metrics** at the business unit level. These metrics are designed in coordination with the enterprise data governance standards.

C-suite teams use **composite metrics** to integrate & simplify the executive analytics dashboard view. Governance standards ensure that data can be rolled up into composites. **OKR's** are used by leading companies to link important goals to individual or team performance.

Organizations ensure executive analytics can be viewed on every digital **presentation** medium (laptop/ tablet/ smartphone, etc) to ensure widest adoption & usage.

Private sector best practices suggest that an organization should **periodically review** its metrics at each leadership level for (a) strategic relevance and (b) business insights.

DoD comparison

DoD components self-manage their respective systems & design new metrics as needed. DoD's ADVANA team is beginning to source component system transactional data into the enterprise repository.

The DSD's executive dashboard view uses composite metrics with drill down capability.

Tablets (with ADVANA) are currently used in senior DoD leadership meetings; Expanding use to all components is vital.

DoD reviews business/operational performance regularly, but may benefit from the typical private sector cadence.

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Key Finding 7

Capability improvements, particularly using artificial intelligence, occur rapidly for organizations once they complete data sourcing

Best Practices

Organizations found that a whole new set of capabilities opened for them once they had sourced, cleaned, and organized their data into a single trusted source.

The most commonly discussed new capability was the use of Artificial Intelligence (AI) and more specifically, Machine Learning (ML) in their analytics.

Organizations that were able to source enterprise data from disparate systems and shift into a data driven culture identified the following capability improvements:

- Empowered users who can self-serve their analytics needs
- Trade-offs & Decision analytics
- Risk Analytics
- Predictive & Prescriptive analytics
- Application of AI/ML tools to drive business performance

DoD comparison

DoD's effort to source data from the 2,500 data systems across the enterprise into a single source is in process. As a result, DoD has some work to do before these increased capabilities can be leveraged across the enterprise.

Because DoD components are self-sufficient in system acquisition & management, there are pockets of analytical excellence where some of these advanced capabilities do exist. The biggest impact & leverage for senior DoD leaders will occur when ADVANA's data sourcing is completed across the enterprise. Focus & resource allocation here is important.

DoD would benefit from a study of the private sector use of AI/ML tools to transform large, complex organizations.

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Recommendations 1-3

The subcommittee would offer 10 recommendations to DoD as a result of this study. These recommendations can be categorized in six groups: Assessment, Compliance, Org Structure, Culture/Skills Dev't/Performance Mgmt., Review, AI/ML implementation

Assessment

The CDAO and CDO council must direct components to perform an assessment of the maturity of the data analytics strategic alignment, capabilities, resources, culture, and the organizational structure utilizing standard maturity models. Assessments enable the creation of a time and resourced-phased plan informed by the integrated results. Robust cultural change management is a critical-to-success element of the plan.

Compliance

The CDAO through the Data Council must ensure measurable component/agency progress of DoD's Data Strategy Implementation Plans is collected and reported up to the DSD level for review each month.

DoD must review existing ADVANA data sharing policies to consider revising data sharing requirements from the Services, COCOMs, DAFAs and Agencies to include: (a) clarifying requirements for transactional data access; (b) establishing compliance dates; and (c) reporting compliance up to the CDAO and DSD level.

Acronyms: DAFA is Defense Agencies and DoD Field Activities
DSD is Deputy Secretary of Defense
COCOM is Combatant Command

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Recommendations 4-5

Organizational Structure

DoD must increase the speed of its progress with onboarding authoritative data systems (ADS) into the enterprise analytics tool (i.e., ADVANA). The CDAO or CIO must allocate appropriate resources to the ADVANA team to increase their current onboarding of the remaining ADS (i.e., 2,200) within the next 2-3 years. In addition, ADVANA must prioritize ADS onboarding and focus on the most critical systems and metrics relative to measuring NDS goals and priorities.

DoD must disseminate analytics SMEs into its components/agencies faster. The CDAO's analytics Center of Excellence (CoE) has 20 SMEs. However, given the size and scope of DoD, it should have 100 to handle all of DoD's 33 components. An increase must occur within the next 12-24 months to populate the critically important (embedded) analytics SMEs needed in each of the components. This will improve DoD's progress towards data strategy and analytics implementation to remain competitive with peer competitors.

Acronyms: CIO is Chief Information Officer SME is Subject matter expert

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Recommendations 6-8

Culture / Skills Development / Performance Management

DoD must create internally funded certification programs and CoE apprenticeships to upskill and reskill DoD civilian employees to improve data literacy and create an organic source of certified data scientists and analysts. Existing employee talent must be harnessed to make progress in DoD's digital transformation.

DoD should direct the DBB to perform a supplemental study of how DCHRMS and other DoD performance management systems can be used or modified to adopt private sector best practices into its performance management systems.

Senior DoD leaders and their organizations must be measured on their use of existing authorities and administrative processes to manage poor performing employees. Existing authorities serve to correct and foster improved employee performance. Cultural transformation requires the ability to shape behavior and off-board employees unwilling to help in the transformation. In cases where existing authorities are insufficient to process poor performers, seek additional authorities.

Acronyms: DCHRMS is Defense Civilian Human Resources Management System

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Recommendations 9-10

Periodicity/Review

The DSD should direct the Defense Business Council* (DBC), to include an external perspective on emerging competitive, economic and logistical trends in its quarterly assessments to the Deputy Management Action Group (DMAG). The external perspective will augment the input from DoD components on the changing defense environment versus the metrics used to measure progress on NDS goals and priorities. The purpose of this assessment is to make recommendations on how ADVANA's current Executive Analytics display should adapt to changing conditions and inform DoD senior leaders more acutely on emerging issues. These recommendations should be presented as part of the DBC's quarterly update to the DMAG.

AI/ML Implementation

As the Data Strategy Implementation Plan is matured, the department would benefit from an investigation on how the private sector is implementing AI/ML to transform business operations, and leveraging best practices in governance.

DMAG is Defense Management Advisory Group. The DMAG is the department's principal governance body for management actions affecting the defense enterprise, including resource management, planning, programming, budgeting, and execution.
AI/ML is Artificial Intelligence / Machine Learning

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Summary

Advance the DoD Data Analytics Journey

- The private sector struggles with the process of implementing enterprise-wide analytics specifically because a number of required capabilities must be established first. This doesn't happen overnight.
- The benefits for organizations that create an enterprise-wide analytics capability are significant and can be the catalyst to propel them into market dominance and keep them there. The cost reduction opportunities are significant for large organizations and often free up needed capital to reinvest in new areas.
- DoD has clearly made a commitment to treat its enterprise data as an asset and use it to develop competitive advantages. It has made progress in areas such as tool development, policy and governance, but still has considerable work to do on the critical areas such as data sourcing and data culture transformation.
- Focus additional time and resources on these two key areas and implement the recommendations as appropriate and DoD will recognize similar benefits to the private sector.
- Further investigate
 - Prioritized and phased approach to optimize benefits and value of DoD data using AI/ML to benefit enterprise business operations and risks
 - Private sector best practices for the removal of barriers to leverage existing HR systems and to realize opportunities to address DoD employee skills identification, performance management and use of analytics across the function.



Defense Business Board

TAB C

LIST OF RECOMMENDATIONS

Key Recommendations Summary

Without impact to existing data analytics initiatives:

1. The CDAO and CDO council must direct components to perform an assessment of the maturity of the data analytics strategic alignment, capabilities, resources, culture, and the organizational structure utilizing standard maturity models. Assessments enable the creation of a time and resourced-phased plan informed by the integrated results. Robust cultural change management is a critical-to-success element of the plan.
2. The CDAO through the Data Council must ensure measurable component/agency progress of DoD's Data Strategy Implementation Plans is collected and reported up to the DSD level for review each month.
3. DoD must review existing ADVANA data sharing policies to consider revising data sharing requirements from the Services, COCOMs, DAFAs and Agencies to include: (a) clarifying requirements for transactional data access; (b) establishing compliance dates; and (c) reporting compliance up to the CDAO and DSD level.
4. DoD must increase the speed of its progress with onboarding authoritative data systems (ADS) into the enterprise analytics tool (i.e., ADVANA). The CDAO or CIO must allocate appropriate resources to the ADVANA team to increase their current onboarding of the remaining ADS (i.e., 2,200) within the next 2-3 years. In addition, ADVANA must prioritize ADS onboarding and focus on the most critical systems and metrics relative to measuring NDS goals and priorities.
5. DoD must disseminate analytics SMEs into its components/agencies faster. The CDAO's analytics Center of Excellence (CoE) has 20 SMEs. However, given the size and scope of DoD, it should have 100 to handle all of DoD's 33 components. An increase in data SMEs must occur within the next 12-24 months to populate the critically important (embedded) analytics SMEs needed in each of the components. This will improve DoD's progress towards data strategy and analytics implementation to remain competitive with peer competitors.
6. DoD needs to create internally funded certification programs and CoE apprenticeships to upskill and reskill DoD civilian employees to improve data literacy and create an organic source of certified data scientists and analysts. Existing employee talent must be harnessed to make progress in DoD's digital transformation.
7. DoD should direct the DBB to perform a supplemental study of how Defense Civilian Human Resources Management System (DCHRMS) and other DoD performance management systems can be used or modified to adopt private sector best practices into its performance management systems.
8. Senior DoD leaders and their organizations should be measured on their use of existing authorities and administrative processes to manage poor performing employees. Interviews with DoD DHRA staff indicated that these authorities are not used frequently due to perceptions of difficulty. Existing authorities serve to correct and foster improved employee performance. Cultural transformation requires the ability to shape behavior and off-board employees unwilling to help in the transformation. In cases where existing authorities are insufficient to process poor performers, seek additional authorities.
9. The DSD should direct the Defense Business Council (DBC), to include an external perspective on emerging competitive, economic and logistical trends in its quarterly assessments to the Deputy Management Action Group (DMAG). The external perspective will augment the input from DoD components on the changing defense environment versus the metrics used to measure progress on NDS goals and priorities. The purpose of this assessment is to make recommendations on how ADVANA's current Executive Analytics display should adapt to changing conditions and inform DoD senior leaders more acutely on emerging issues. These recommendations should be presented as part of the DBC's quarterly update to the DMAG.
10. Once the Data Strategy Implementation Plan is complete, the department would benefit from an investigation on how the private sector is implementing AI/ML to transform business operations, and leveraging best practices in governance.



Defense Business Board

TAB D

Methodology and Interviews

Methodology:

With an expectation that the interviews with C-Suite leaders of Fortune 500 companies would yield a wide-range of value and content, the approach to interviews was designed to ensure that key topics were addressed and also allow the interviewees to raise related considerations. This Board's conversations with the C-Suite executives primarily centered on the best practices used and lessons learned during their organization's journey to implement an enterprise-wide analytics capability.

The study interview questions included the following topics:

- The quantity and type of metrics viewed by the C-Suite and Board of Directors as well as those at lower levels
- Design of metrics and the process of integrating/combining multiple metrics
- Use of internal and external (competitive) benchmarking in metrics
- How metrics are used to predict or identify risk
- Process to address operational issues/concerns raised by metrics
- Process to prioritize the demand for data analytics in the organization
- Presentation and communications methods for executive analytics throughout the organization
- Linkage between the organization's strategic goals and the incentives/performance measurement of the average employee
- AI/ML use in analytics
- The organization structure of the data analytics team
- Culture impacts on transformation
- Celebrated use cases
- Organizational lessons learned in the implementation or improvement of data analytics.

Interview Population

During the course of the study, forty-eight individuals were interviewed within thirty-six interviews. The interview population included a mix of current and former DoD senior leaders, academic thought leaders, as well as a mix of Fortune 500 CEOs, COOs, CFOs, CIOs, CDOs and other advanced analytics executives. DoD leaders comprised 28% of total interviews. The companies interviewed were chosen because of their reputation using advanced analytics. The selection captured a range of industries, organizational approaches, and corporate culture.

The interview population included:

- 6 CEOs from companies in the e-commerce, private equity, healthcare, aerospace, and management consulting sectors.
- 10 COOs from companies in the technology, defense, banking, healthcare, aerospace, manufacturing, and financial sectors.
- 6 CFOs from companies in the technology, manufacturing, defense, consumer product manufacturing, and digital services sectors.
- 5 CDOs from companies in the pharmaceutical, technology, manufacturing, management consulting, and financial services sectors.
- 9 SVP's & VP's Data Analytics Executives from companies in the digital content services, technology manufacturing, technology consulting services, consumer product manufacturing, and aerospace sectors.
- 8 Current & Former DoD leaders from OSD, CDO, A&S, USAF, USA, DHRA and JCS.
- 1 Former SecDef.
- 3 Academics with expertise in Advanced Analytics and KPIs.

In addition, publicly available academic literature enhanced the content from the interviews with the executive and C-Suite leaders. In particular, several C-suite executives interviewed knew that their organizations used Data and Analytics maturity models to chart their digital journey, however, they were less familiar with specific models. From academic and industry journals, we acquired additional insights on data maturity and governance models.



Defense Business Board

TAB E

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Defense Business Board

TAB F

Subcommittee Member Bios

Linnie M. Haynesworth

**Board Director, Truist Financial Corp, Automatic Data Processing, Inc., and Micron Technology, Inc.
Former Sector Vice President and General Manager, Northrop Grumman Corporation.**

Ms. Haynesworth serves as a board director on three public company boards where she sits on the Audit, Technology and Governance and Sustainability committees.

Linnie also serves on non-profit boards including the Fairfax County Economic Development Authority (FCEDA) Commission, the Flint Hill School Trustees. She has also served on the boards of the Northern VA Technology Council, and the Intelligence & National Security Alliance (Audit Committee).

Ms. Haynesworth is a highly regarded operational leader with an extensive background in technology integration, cybersecurity risk management, strategic planning and large complex software-intensive system development, delivery and deployment to US government and international customers. With P&L operational responsibility for multiple \$1B+ divisions, she retired in 2019 as the Sector Vice President and General Manager of the Cyber and Intelligence Mission Solutions Division for Northrop Grumman Corporation's (NGC) Mission Systems Sector. Linnie also led Engineering, Supply Chain and Product Development functions for the NGC space sector.

Ms. Haynesworth received her BS in Electrical Engineering from the University of Southern California (USC) and is the 2019 recipient of the USC Viterbi School of Engineering Mark A. Stevens Distinguished Alumni Award.

David Beitel

Chief Technology Officer, Zillow Group

As Chief Technology Officer of Zillow Group, David oversees the internal and external technical engineering, product development, and technology operations teams.

David joined Zillow in 2005 as a member of the founding team and is one of the company's first executive leaders. In addition to his role as CTO, David helped develop and build Zillow from a small startup to a household name and was named the region's Most Innovative CTO by the Puget Sound Business Journal in 2012.

Prior to Zillow, David was CTO of Expedia, where he joined as one of its earliest team members and spent 12 years. David started his career at Microsoft in the handheld computing group.

David earned a Bachelor of Science in Computer Science and Master of Engineering in Computer Science from Cornell University. He is a board trustee and advisor with a number of advocacy, education and charitable organizations, including Cornell University CIS, University Prep, and T4A.org.

Oscar Munoz

Executive Chairman & Former CEO, United Airlines Board Member CBRE, Univision, and USC Board of Trustees

Oscar Munoz has served as executive Chairman of the Board of Directors of United Airlines Holdings Inc. since May 2020. He previously served as the company's Chief Executive Officer from September 2015 until his Executive Chairman appointment.

Mr. Munoz has served on the board of directors of United Airlines Holdings Inc. since 2010, and he served on the board of directors of Continental Airlines Inc. from 2004 to 2010.

He currently serves on the board of directors for CBRE Group Inc. and Univision Holdings Inc., and sits as an independent trustee on Fidelity's Equity & High Income Funds Board.

Prior to United, Mr. Munoz served as President and Chief Operating Officer of CSX Corporation, a railroad and intermodal transportation services company, from February 2015 to September 2015; as Executive Vice President and Chief Operating Officer of CSX from 2012 to 2015; and as Executive Vice President and Chief Financial Officer of CSX from 2003 to 2012. He also served on the board of directors of CSX from February 2015 to September 2015.

Dr. David M. Van Slyke, Ph.D

Dean of the Maxwell School of Citizenship and Public Affairs Syracuse University

David M. Van Slyke is Dean of the Maxwell School of Citizenship and Public Affairs at Syracuse University and the Louis A. Bantle Chair in Business-Government Policy. Prior to becoming Dean in July 2016, Mr. Van Slyke was Associate Dean and Chair of Maxwell's department of public administration and international affairs, home to the country's #1 ranked graduate degree in public affairs. He is a tenured, full professor of the Maxwell School and the College of Arts and Sciences and a two-time recipient of the Birkhead-Burkhead Award and Professorship for Teaching Excellence.

Mr. Van Slyke is a leading international expert on public-private partnerships, public sector contracting and contract management, and policy implementation. He is Director and Fellow of the National Academy of Public Administration, a co-editor of the Journal of Public Administration Research and Theory and the Journal of Strategic Contracting and Negotiation. He also sits on the editorial boards of several top-ranked public affairs journals. He has provided expert guidance to the Office of Management and Budget, the Government Accountability Office, the U.S. Coast Guard, and the World Bank. As part of his work and research he has worked extensively with senior leaders in government, nonprofit and business organizations in China, India, Peru, Singapore, Thailand and many other countries through the Maxwell School's Executive Education program.

Mr. Van Slyke's most recent book, *Complex Contracting: Government Purchasing in the Wake of the U.S. Coast Guard's Deepwater Program* (Cambridge University Press, 2013) is the recipient of the American Society for Public Administration Section on Research Best Book Award for 2014 and honorable mention for the Public and Nonprofit Section of the Academy of Management best book award for 2016. He is winner of the 2015 Distinguished Alumnus in Public Administration and Policy award from the Rockefeller College of Public Affairs and Policy and the 2007 Beryl Radin Award for Best Article published in the Journal of Public Administration Research and Theory.

Mr. Van Slyke earned a Ph.D. in public administration and policy from the Rockefeller College of Public Affairs and Policy at the University at Albany, State University of New York. Prior to becoming an academic, he worked in the private, public and nonprofit sectors.

General Joseph L. Votel

General Joseph L. Votel is a retired U.S. Army Four-Star officer and most recently the Commander of the U.S. Central Command –responsible for U.S. and coalition military operations in the Middle East, Levant and Central and South Asia. During his 39 years in the military, he commanded special operations and conventional military forces at every level. His career included combat in Panama, Afghanistan and Iraq. Notably, he led a 79-member coalition that successfully liberated Iraq and Syria from the Islamic State Caliphate. He preceded his assignment at CENTCOM with service as the Commander of U.S. Special Operations Command and the Joint Special Operations Command.

Votel was recognized with the Distinguished Military Leadership Award from the Atlantic Council, the U.S. – Arab Defense Leadership Award from the National Council on U.S. - Arab Relations, the Patriot Award from the Congressional Medal of

Honor Society, the SGT James T. Regan Lifetime Achievement Award from the “Lead the Way” Foundation and the Freedom Award from the Intrepid Sea, Air and Space Museum.

In January of 2020, General Votel became President & CEO of Business Executives for National Security (BENS). He is a Strategic Advisor for Sierra Nevada Corporation as well as a member of the Board of Trustees for Noblis Corporation. Votel is a non-resident Distinguished Fellow at the Middle East Institute and the Belfer Center at the John F. Kennedy School of Government and advises the Combating Terrorism Center at West Point. He sits on the Executive Board of Freedom House and the Center for Ethics and the Rule of Law (CERL). He serves on the Board of Directors for Service to School, Minnesota Wire, Digital Force Technologies and Owl Cyber Defense. He is a member of the Council on Foreign Relations.

Votel is a 1980 graduate of the United States Military Academy and earned master’s degrees from the U.S. Army Command and Staff College and the Army War College. He is married to Michele; and they have two grown sons, a daughter-in-law and two grandchildren. The Votels reside in Lake Elmo, Minnesota.

The Honorable David M. Walker

Former Comptroller General of the United States

Mr. Walker is a non-practicing CPA and a nationally and internationally recognized fiscal responsibility, government transformation/accountability, human capital, and retirement security expert. He has over 40 years of executive level experience in the public, private and non-profit sectors, including heading three federal agencies, two non-profits, and serving as Comptroller General of the United States and CEO of the U.S. Government Accountability Office (GAO) for almost 10 years.

Mr. Walker most recently served as the Distinguished Visiting Professor (William J. Crowe Chair) at the U.S. Naval Academy where he teaches the Economics of National Security. Previously, he served as a Senior Strategic Advisor for PwC’s Public Sector Practice (now Guidehouse). Mr. Walker was the Founder, President and CEO of the Comeback America Initiative (CAI). Prior to founding CAI, Mr. Walker served as the first President and CEO of the Peter G. Peterson Foundation that promotes fiscal responsibility. Previously, he served as the seventh Comptroller General of the United States and head of the U.S. Government Accountability Office (GAO) for almost ten years (1998-2008). GAO conducts financial, performance and compliance audits, a range of policy and operational research and analyses, promulgates Generally Accepted Governmental Auditing Standards, and renders decisions on bid protests on federal contracts.

Under Mr. Walker’s leadership, GAO underwent a dramatic and highly successful transformation which, among other things, resulted rightsizing the agency, significantly increasing its visibility, credibility and productivity, and achieving over \$380 billion in financial benefits and many other non-financial benefits over a 10-year period.

Mr. Walker’s appointment as Comptroller General was one of his three presidential appointments each by different Presidents (i.e., Reagan, Bush 41, and Clinton) during his 16 years of total federal service. He was confirmed unanimously by the U.S. Senate for all three of his Presidential appointments. His previous Presidential appointments were Assistant Secretary of Labor for the current Employee Benefit Security Administration, and as one of two Public Trustees for Social Security and Medicare. Mr. Walker also served as Acting Executive Director, Deputy Executive Director and Chief Negotiator for the Pension Benefit Guaranty Corporation. He also has over 20 years of private sector experience, including approximately 10 years as a Partner and Global Managing Director of the Human Capital Services Practice for Arthur Andersen LLP. His initial private sector experience was with Price Waterhouse & Co., Coopers & Lybrand and Source Services Corporation.

Mr. Walker currently serves on various government and non-profit boards and advisory groups, including the Defense Business Board. He has served as Chairman of the Independent Audit Advisory Committee (IAAC) for the United Nations, Chairman of the U.S. Intergovernmental Audit Forum, and as a member of the Board of Directors for the International Organization of

Supreme Audit Institutions, AARP, the Committee for a Responsible Federal Budget, the Partnership for Public Service, and the Connecticut Municipal Accountability Review Board. He is also a past member of the Trilateral Commission.

Mr. Walker is an inductee in the Accounting Hall of Fame, the Internal Audit Hall of Fame, the National Academy of Public Administration, and the National Academy of Social Insurance. In addition, he is a member of and has held various leadership positions in Rotary International and the Sons of the American Revolution (SAR).

Mr. Walker is also a writer, speaker and media commentator. He has authored four books, the latest was entitled *America in 2040: Still a Superpower (A Pathway to Success) Comeback America: Turning the Country Around and Restoring Fiscal Responsibility* (2010), which achieved National Bestseller status, and he plans to publish a fourth book in 2021. He has appeared in several major programs and documentaries, including being the primary subject in a 60 Minutes segment and the critically acclaimed documentary *I.O.U.S.A.*

Mr. Walker has a B.S. in Accounting from Jacksonville University, an SMG Certificate from the JFK School of Government at Harvard University, a Capstone Certificate from the National War College, and four honorary doctorate degrees from American University, Bryant University, Jacksonville University and Lincoln Memorial University. He has won numerous national and international leadership, professional, and public service awards, including top awards from two heads of state (i.e., Austria and Indonesia) and two U.S. Cabinet Secretaries (i.e., Defense and Labor), the top award for his CPA profession (i.e., AICPA Gold Medal), and the first and only Alexander Hamilton Award for economic and fiscal policy leadership from the Center for the Study of the Presidency and the Congress.

Safroadu “Saf” Yeboah-Amankwah

Senior VP & Chief Strategy Officer, Intel

Safroadu “Saf” Yeboah-Amankwah is senior vice president and chief strategy officer (CSO) at Intel Corporation. Yeboah-Amankwah leads Intel’s Global Strategy Office, including Intel Capital, and works with the executive team on developing and driving growth-oriented strategies.

Yeboah-Amankwah joins Intel from McKinsey & Company, where he was most recently a senior partner and global head of the Transformation Practice for the Telecom, Media and Technology (TMT) practice, based in Washington, D.C. He is also the global lead of Client Capabilities for the TMT practice. Previously he served as managing partner for South Africa and head of McKinsey’s TMT and Digital practice for Africa, among other roles.

Yeboah-Amankwah received both his bachelor’s and master’s degrees in electrical engineering and computer science from the Massachusetts Institute of Technology. He is a former board member of the United Negro College Fund.

Education:

MIT Electrical Engineering and Computer Science 1993, Master’s Engineering 1994

Experience:

McKinsey & Company (26 yrs 3 mos)

Senior Partner Sep 2018 – Nov 2020; Washington, DC

Senior Partner Sep 1994 – Nov 2020

During his time in Africa, Saf was one of McKinsey’s experts on doing business in Africa and he led the firm’s work in digital and telecommunications across Africa. While in that role, he supported the turnaround of a leading local telecom operator and led a three-year transformation program at one of Africa’s largest retail banks. He also supported a global private-equity firm in turning around an African multinational focused on the agricultural value chain.

His other efforts helped a high-tech multinational develop a growth strategy for its African operations that led to a 3X improvement in sales and he co-led a three-year transformation for one of the largest telecom OEMs, encompassing operations in North America, Europe and Asia.



Defense Business Board

TAB G

Glossary

Glossary

A&S- Acquisition and Sustainment
ADS- Authoritative Data System
AI- Artificial Learning
BI- Business Intelligence
BOD- Board of Directors
BU- Business Unit
CEO- Chief Executive Officer
CDAO- Chief Data Analytics Officer
CDAO- Chief Data Artificial Intelligence Officer
CDO- Chief Data Officer
CFO- Chief Financial Officer
CIO- Chief Information Officer
COCOM- Combatant Command
COE- Center of Excellence
COO- Chief Operating Officer
CPO- Chief People Officer
DAFA- Defense Agencies and Field Activities
DAMM- Data Analytics Maturity Model
DBB- Defense Business Board
DCHRMS- Defense Civilian Human Resources Management System
DDS- Defense Digital Service
DEI- Diversity, Equality, Inclusion
DMM- Data Maturity Model
DSD- Deputy Secretary of Defense
ELT- Executive Leadership Team
ETL- Extraction Transformation Load
FACA- Federal Advisory Committee Act
HR- Human Resources
HRO- Human Resources Office
IT- Information Technology
JAIC- Joint Artificial Intelligence Center
JCS- Joint Chief of Staff
KPI- Key Performance Indicator
ML- Machine Learning
NDAA- National Defense Authorization Act
NDS- National Defense Strategy
OKR- Objectives and Key Results
OSD- Office Secretary of Defense
OTS- Off The Shelf
RBU- Reporting Business Unit
ROIC- Return On Invested Capital
SAAS- Software as a Service
SME- Subject Matter Expert
TOR- Terms of Reference
USA- U.S. Army
USAF- U.S. Air Force



Defense Business Board

TAB I

Public Comments

Public comments received go here.



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